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# Electrical World

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W. H. ONKEN, JR.
*Editor*

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## *"Just a Fair Living"*

IN THESE words Martin J. Insull, speaking at last week's public relations conference of the operating companies of the New England Public Service Company, at Augusta, Me., summarized the material results of hard work in the electric light and power industry. Pointing out that the tangible reward of shouldering big burdens to carry electric service to an ever-increasing public is only a fair living, the speaker declared that the chief incentive for such heavy toil is the satisfaction of "making two blades of grass grow where one grew before, which is the final reason for wanting to accomplish anything big and worth-while." The truth of Mr. Insull's phrasing may be questioned by those who have never looked behind the scenes into rooms where bankers, utility executives, department heads and operating engineers grapple with the problems of system development and service betterment, or by those who have missed the thrill brought by a comprehension of the devotion of staffs and employees to duty under conditions that tax human endurance to the extreme. It will not be scoffed at by those who realize the limited returns on capital associated with public utility activities, the joy in creating efficient organizations and *materiel* to serve all society electrically, and the privilege of sharing in the advancement of the most wonderful of the modern useful arts. These are compensations unknown to the profiteer, members of whose species are few and far between in the habitats of the light and power industry.

* * * *

## *Economic Factors Govern Bond Prices*

LAST summer the ratio between demand and supply of power and light bonds was temporarily deranged, and the supply on bankers' shelves accumulated inconveniently. Referring to the incident recently, a representative of one of the largest institutional investors in the country said to a group of bankers: "You gentlemen and the borrowers of capital have been reveling for about two years in a sellers' market. In such a period it is not surprising that the strong wine of success and prosperity should go to your heads, making you disregard some of the reasonable needs of the investor, making you forget that the capacity of the buyer is not boundless and that his appetite can in time be dulled by constantly boosted prices. This was the reason for the painful attack of indigestion last June."

Evidence is lacking that there has been any factor in the price rise beyond the economic relation between supply and existing or potential demand—accelerated, of course, by aggressive marketing activities. If insufficient attention be paid to the timing of new issues, so that too many are placed on the market at one time, what has been called indigestion will naturally occur. Fortunately, investment bankers have commenced to pay more attention to this point. But recent financing has been carried on at still lower rates than those ruling last summer, and new issues are being absorbed very readily. The price of money is determined by a combination of economic factors which authorities generally agree point to still lower levels for power and light financing, in view of the fact that these issues have been selling out of line in relation to railroad issues and possibly others of lower yield and that their merit is just now being appreciated. The rise in price does not seem to require any explanation involving artificial manipulation.

* * * *

## *Senator Walsh Restricts the Scope of His Resolution*

HEARINGS before the Senate committee on interstate commerce to determine whether or not there shall be an investigation of the electric light and power industry, and if so what the scope of that investigation shall be, were resumed on Tuesday last. Up to that time the public utilities' had not been heard nor had any case been made against them. However, representatives of the state public service commissions were very outspoken and effective in their demand that Congress do not encroach on the rights of sovereign states in any investigation it may order. In fact, the burden of their testimony indicated that the state commissions have handled and can handle the situation satisfactorily in so far as the ultimate consumer and the rates he pays for service are concerned. Even where electricity crosses state lines, joint action by the commissions of the states involved has been effective. Investment bankers and large investors in public utility securities, such as insurance companies, have also urged the necessity of caution on the part of the interstate commerce committee lest public confidence in the financial stability of the public utilities be shaken and they experience difficulty in raising the billions needed for extensions and betterments of service in every part of the country.

The most significant event of the hearing up to the time mentioned, however, has been the fact that Senator Walsh, when confronted with legal objections to the elaborateness of the investigation he proposed, offered to modify his resolution and restrict its scope. Thus the entire situation may be changed. As a result the utility companies, which might previously have been expected to oppose the resolution even more vigorously than the commissioners, bankers and insurance companies had done, may find watchful waiting more effective than elaborate defense.

## *Aviation and Transmission Lines*

LANDING is one of the most difficult operations in aviation, particularly during forced descents. It will probably remain a great hazard unless some revolutionary development such as the neutralization of gravity by other than mechanical means comes about. Among the many dangers of a forced landing at night is the possibility that the descent may end by a collision with one of the electric transmission lines which are spreading over the whole country.

Near and around many flying fields this danger is now guarded against by placing red lights on a sufficient number of the poles to indicate the location of the line. It is not now practicable thus to indicate the positions and routes of transmission lines throughout their whole lengths, but such precautions are being asked for, and it is certain that the future will see not only a great increase in the number of such requests, but probably also the substitution of demands in the place of requests. Already one large interconnected system has been asked so to indicate some of its lines along traveled air lanes. It would not be impossible to mount a floodlamp and a small transformer on every transmission pole and tower in the country. But it would probably be impossible to operate any line so equipped satisfactorily. Furthermore, the power companies can hardly be expected to spend the money to do it.

However, is it necessary that the problem be solved in this way? Possibly a satisfactory solution is already at hand. Claude and other glow-tube illuminants are already finding large commercial applications. They require high voltages at the tube terminals. High voltages are available at the ends of the cross-arms on every transmission pole and tower. To the observer in the sky twenty years from now perhaps the earth at night will be an eerie sight to look upon, with varicolored glowing lines marking the routes of transmission. Or electromagnetic radiations from the transmission lines may be used through the medium of detectors on the airplanes to indicate proximity of danger.

* * * *

## *Definitions Needed for Industry Terms*

MANY words used by electrical men have not been defined. Such a word is "interconnection." It may mean a transmission system, a tie line, a network or a busbar for generating stations. A definite economic meaning is a transmission line between two electrical systems of different ownership in which energy may flow in either direction. Another modification would mean a line between two separately operated electrical systems in which energy may flow in either direction. If there is no provision for two-way energy flow between individual systems, the term "transmission line" should be used. As now used, "interconnection" gives as loose a conception of actualities as does "superpower" or "giant power."

"Load factor" and "capacity factor" continue to be used as economic yardsticks. But they are not so valid as in the days when electrical systems became connected together. On many properties energy is purchased in large amounts or is sold to other utilities in large amounts. In other cases generating-station equipment is used as a regulatory device for system voltage or power-factor control. These developments in operating practice call for a revision of old terms or the addition of new terms. A load factor and plant factor based on owned generating equipment and the energy it produces have value, but system load and plant factors wherein all generated and purchased energy and equipment are considered are of greater economic importance. Many utilities now mix generated energy, purchased energy and owned and interconnected generating capacity to give meaningless load and capacity factor values. Utility practice should be more uniform.

It is important that terms used in economic measures and comparisons be defined more rigidly. New and useful terms may be needed to measure values on the present extended systems. A study of these things would be worth-while work for the N. E. L. A. and A. I. E. E. committees most intimately concerned with the formulation of definitions. Electrical men should talk the same language and should be precise in their use of words.

* * * *

## *Criticism and Praise for the Commercial Section*

PROGRESS in the commercial thinking of the power industry has been very clearly mirrored at the group meeting of the N.E.L.A. Commercial Section committees in recent years. Last week eleven of these committees were in session in Chicago, with more than two hundred men in attendance. Out of this gathering come some very definite reflections.

No one can deny that the Commercial Section is on the march. It has been fortunate in the energetic leadership of a small group of men who recognize not only the opportunity but the responsibility that waits upon their action. And so, particularly in the last two years of Chairman Davidson's administration, there have been more purpose, more courage and more spirit in the work. But there still remains one very fundamental weakness in the situation that needs deliberation and attention. Frankly, there is far too great a willingness among the sales managers who journey to these meetings to devote themselves to the criticism of the programs offered by the chairmen of the committees, with a complete disregard on their own part of any obligation to contribute to the planning. The committee chairmen were well chosen this year. They have been conscientious in their efforts. But the lingering impression of last week's meetings was one of discouragement that these men, with bumper attendance, could secure so little active assistance and support out of their meetings from men eager-minded to improve the planning and promote its application.

Some gratifying progress was made, however, by several of the groups. The general merchandising committee made an outstanding contribution in bringing to a successful close a series of joint conferences with the national associations of the other retailers of electrical appliances, the purpose of which was to define some guiding principles by which to mold the oft-conflicting merchandising policies of both the power companies and the competing trades. Chairman Greenwood has rendered a splendid service by this achievement and deserves the thanks of the industry. His committee is also undertaking a broad laboratory and field study of the oil burner and is launching a national contest to promote residence consumption. The electrical adver-

tising and power committees also are showing enterprise.

More than ever is seen the need for a commercial executive at headquarters who can assist committee work, support and stimulate the chairmen, develop a more orderly procedure and bring continuity of purpose and program. Chairman Davidson announced that such a man would probably be appointed within a few weeks. This is good news.

* * * *

## *Needed Betterments in Interconnection Practice*

AS LOADS upon interconnected systems increase the pressure upon operators to furnish service of the highest grade over wide areas grows apace. Managers with vision are thinking intently about ways and means of improving practice. Fine work has been done in the past in this field, but in some cases development has been so rapid that erratic service and unfortunate interruptions have crept into operation, and these need to be taken in hand at once. If matters are allowed to drift, some power companies may have to discontinue interconnected operation in order to maintain the quality of service demanded by economic conditions in certain areas of major importance, and the art will be retarded by just so much.

Several lines of treatment are indicated, as our medical friends express it. Among these are improved communication, better records of intersystem procedure as apart from log-sheet data, the maintenance of increased local reserve capacity ready for immediate use, more intercompany visits and co-operative discussions by engineers and operators, interchange of written information and data along broader lines, provision for the education of load dispatchers in the more professional phases and larger problems of intersystem working, and the devotion of more engineering study to the problems of system ties and allied apparatus from the standpoint of service reliability.

It would take many pages to discuss each of these betterments thoroughly. Steps are being taken on many properties to eliminate the handicaps of inadequate communication under normal conditions, as well as to provide for emergencies. Too much indirect communication still hampers operators seeking to act promptly with complete understanding of conditions outside their own systems. Rapid progress is being made in the application of selective telephone equipment to carrier transmission over power wires, and good headway is also being made in the improvement of ordinary wire facilities between points hitherto reached circuitously. Space radio appears to have possibilities, at least in emergencies, but we shall know more about this in the near future. In the field of records, loose-leaf systems offer a means of more effectively preserving comments, notes and data bearing upon specific interconnection problems than the log sheet permits, and it would be helpful if a wider interchange of forms for such work took place.

Executives are responding in progressive companies to the appeal of more complete instrumentation in connection with tie-in service, and considerable work is being done on the problem of obtaining simultaneous load readings. Operators are getting better acquainted by personal contacts brought about through such means as the New England System Operators' Club, for example, and by at least occasional visits to neighboring dispatching offices. Reserve capacity is still too much neglected locally, many operating men apparently thinking that this can be cut to the bone under interconnection, whereas sudden reversed demands of the order of from 20,000 kw. to 60,000 kw. are not uncommon in large work, with their decidedly "bumpy" effect on regulation and frequency control. The installation of more than one high-powered transmission circuit on a single tower line is being questioned, and so it goes. These and other live issues need to be faced very frankly in view of their bearing upon quality of service. Protection against lightning is a vital problem in interconnection. In some areas 90 per cent of the tie-in troubles have been credited to Nature's heavy artillery, and the economic side of such protection in relation to load values presses for consideration.

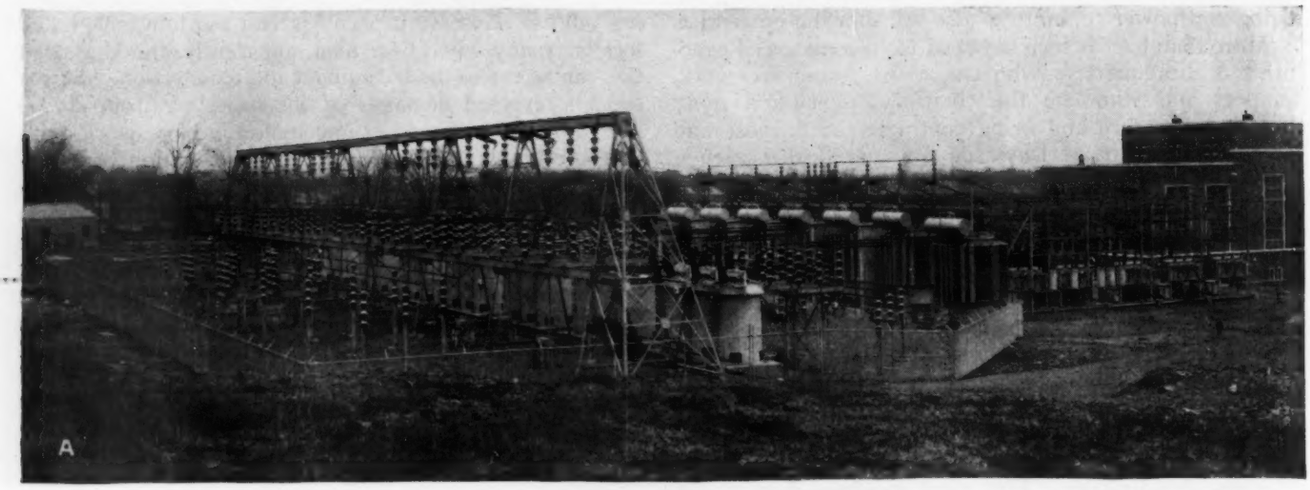
* * * *

## *Midwinter Meeting of Leagues Shows Trend from Talk to Work*

SOME men have felt that the league conferences held each year at Association Island have provided too little time for the discussion of the practical problems of operating a local electrical league. The major purpose at "the Island" has been to interpret the league movement to the industry, and to the league men their responsibility to national policies. Therefore a mid-winter conference of league officials was held last week in Chicago devoted entirely to questions of local administration and development. About a hundred men were present, representing thirty-five active leagues that are engaged in promotion work, scattered from Boston to Denver and from Winnipeg to New Orleans. It was an earnest, hard-working meeting that lasted two days and was enthusiastically voted a successful experiment.

It would seem that here also co-operation is trending out of the talking stage into the working stage, and the league men are becoming less concerned with their local independence in policy and program and more interested in tying into national movements that offer practical opportunities for effective co-ordination in market development. A few years ago every league felt that to operate the "red seal" plan each city should set its own standard of adequacy in house wiring. But last week they voted to establish a national specification so that the idea may be nationally advertised and adapted to the thousands of house plans that now emanate from agencies doing a country-wide business. And the "red seal" plan is now being revised to remove former restrictions and facilitate its use, so that the leagues can put more power behind the present movement to make house wiring adequate. Here lies the chief immediate purpose in league thinking—which is as it should be.

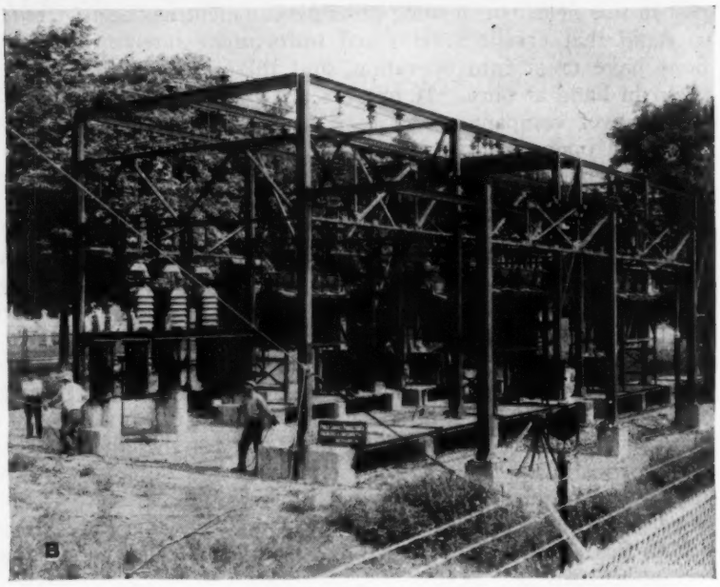
Another encouraging sign was the frank discussion of the small house-wiring contractor as a league responsibility. He does not belong to the league at present. But it was agreed that the league must reach him and influence him to do a more adequate job. Also, there was a demand for more service from the members of the League Council, that these men should take responsibility for visiting all the leagues of their districts, to bring them the outside viewpoint and to study league problems more closely as of growing importance in the making of national plans. The council will take on this broader function. It was a meeting of unusual interest and very satisfying results.

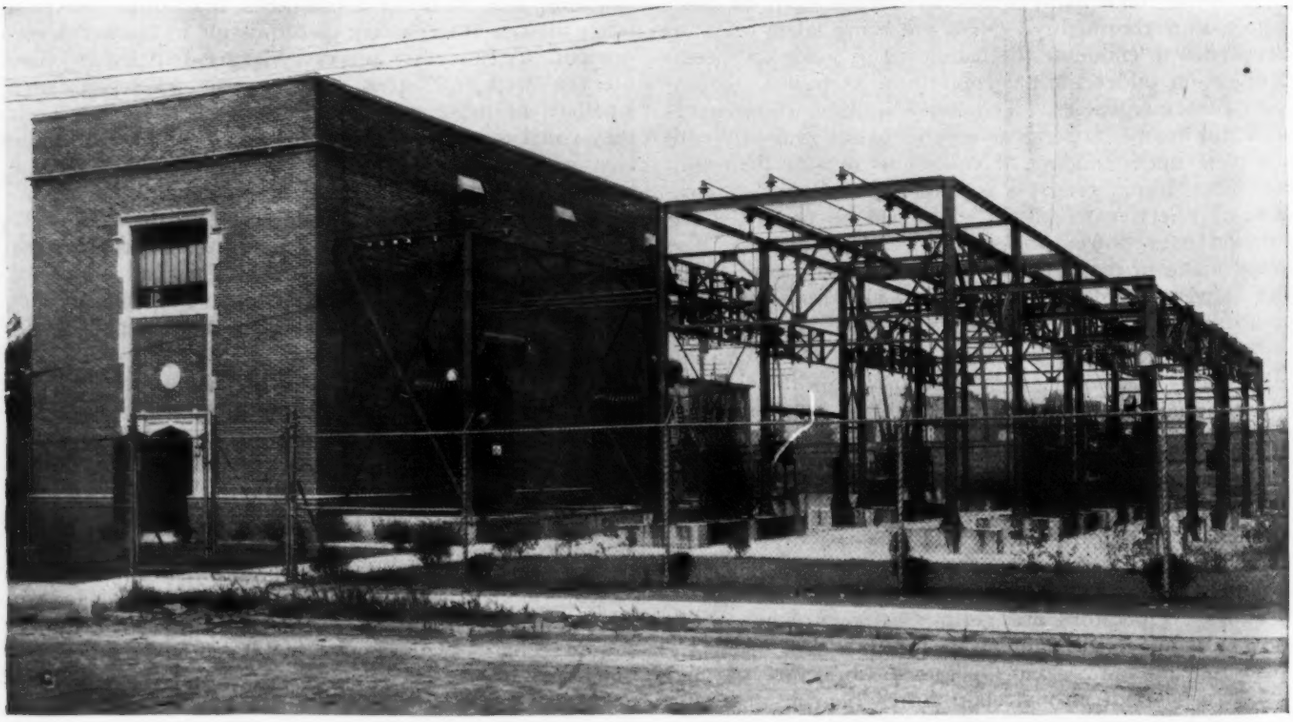


## *Modern Jersey Substations*

THE Public Service Corporation of New Jersey has been engaged in a major program of substation building. High-voltage switching stations have been built with a view to future interconnections and extension of the 132-kv. transmission system. These substations use the supported bus structure design. A second type, designed for large city service, incorporates a control building with an outdoor installation. A third design serves small towns or isolated industrial plants.

A—Athenia switching station.
B—Outdoor substation for serving Princeton.
C—Bergen Point substation for local service.





# Economy of High Efficiency

## in the Medium-Sized Power Station

Method of analysis outlined. High-temperature steam justified. Effect of capacity factor and fuel cost is dominant

By Alfred Iddles

*Chief Engineer Day & Zimmermann Engineering & Construction Company*

*Many large power stations have warranted the installation of equipment that will give very high economy in operation. High pressures and temperatures, air heaters and economizers, water-cooled furnaces with high rates of heat absorption and other advanced practices have been used successfully. Prospects for the design and installation of many small stations make it advisable to evaluate these advances in the art for the smaller plants. In this article Mr. Iddles has outlined a method of attack in detail. The data will vary in an individual case and local conditions will modify conclusions, but the method of analysis is general and should serve as a guide to station designers. Mr. Iddles used specific data to make clear the method, and it is hoped that this article will stimulate design thinking for the medium-sized power station.*—Editor.

POWER plant design has received a great deal of engineering attention during the last ten years. With the increasing cost of coal it became economically possible and necessary to get higher efficiencies. Whereas before the war stations producing power at 2 lb. of coal per kilowatt-hour were considered very efficient, we now have large central stations that produce a kilowatt-hour for about 1 lb. of coal. The question often arises whether the higher investment and maintenance charges do not overshadow the reduced fuel costs of these highly efficient plants and whether it is advisable for small and medium-sized power plants to install the heat-saving devices used by these large modern stations. Quite often it is reasoned that if high efficiency pays for the larger stations, it must also be advantageous for the smaller plants.

So many variables enter into the production costs of electric energy that no direct answer can be given to these problems; each plant design should be considered on its own merits, subject to the variables applying to that plant, such as price of fuel, load, etc. Nevertheless it is possible to make fair comparisons between different plant designs and to predict fairly accurately which layout will be the most economical at various loads and fuel prices. It is the purpose of this article to show comparative production costs of various designs for a medium-sized power plant.

### Basic Assumptions for Design

Assume that a power plant is needed which has to produce 125,000,000 kw.-hr. per year and that the daily loads are about as follows: eight hours at 7,500 kw., thirteen hours at 16,000 kw. and three hours at 25,000 kw. With three 10,000-kw. turbo-generators the load can be carried very economically and in case of serious trouble to one of the units the peak load can still be carried on two machines. Three 1,000-hp. boilers would carry the peak load when operated at about 300 per cent rating and four boilers should be installed in order to have a spare.

### Fixing Steam Pressure and Temperature

In determining steam conditions pressures over 400 lb. will likely not be considered, since it would require reheating of the steam between the high- and low-pressure stages, which of course would be too complicated and costly for a plant of this size. Comparing production costs with steam at (*a*) 250 lb., 600 deg. F.; (*b*) 250 lb., 700 deg. F., and (*c*) 400 lb., 700 deg. F. ought to give a fair idea of which steam condition to select. The following conditions will obtain if these assumptions are made:

| | (*a*) | (*b*) | (*c*) |
|---|---|---|---|
| Steam consumption, lb. per kw.-hr. at 28½ in., vacuum | 11.25 | 10.3 | 9.9 |
| Heat in steam, B.t.u., per lb. | 1,313 | 1,362 | 1,356 |
| Heat in feed water, B.t.u., per lb. | 180 | 180 | 180 |
| Heat supplied by boiler, per lb. of steam | 1,133 | 1,182 | 1,176 |
| Heat supplied by boiler, per kw.-hr. | 12,780 | 12,200 | 11,640 |

With 13,000 B.t.u. coal and 75 per cent boiler efficiency 125,000,000 kw.-hr. per year will require:

(1) $125{,}000{,}000 \times (12{,}780 - 12{,}200) \div (13{,}000 \times 0.75 \times 2{,}000) = 3{,}725$ tons of coal more for 250-lb. 600-deg. F. steam than for 250-lb. 700-deg. F. steam.

(2) $125{,}000{,}000 \times (12{,}200 - 11{,}640) \div (13{,}000 \times 0.75 \times 2{,}000) = 3{,}600$ tons of coal more for 250-lb. 700-deg. F. steam than for 400-lb. 700-deg. F. steam.

(3) $125{,}000{,}000 \times (12{,}780 - 11{,}640) \div (13{,}000 \times 0.75 \times 2{,}000) = 7{,}325$ tons of coal more for 250-lb. 600-deg. F. steam than for 400-lb. 700-deg. F. steam.

The pumping of boiler-feed water to the 400-lb. pressure boilers would require 480,000 kw.-hr. per year more than pumping to 250-lb. pressure boilers; this necessitates the burning of about 300 tons of coal per year more to feed the high-pressure boilers, so that there will be required (1) 3,725 tons of coal more for 250-lb.

600-deg. F. steam than 250-lb. 700-deg. F. steam, (2) 3,300 tons of coal more for 250-lb. 700-deg. F. steam than for 400-lb. 700-deg. F. steam, (3) 7,025 tons of coal more for 250-lb. 600-deg. F. steam than for 400-lb. 700-deg. F. steam.

The differences in first cost of plants for the three conditions named occur mainly in the boilers, superheaters, boiler-feed pumps, piping and condensing equipment. These costs will be about as follows:

| | (a) | (b) | (c) |
|---|---|---|---|
| Four boilers and superheaters | $112,000 | $120,000 | $130,000 |
| Two feed pumps | 12,000 | 12,000 | 17,000 |
| Piping | 200,000 | 200,000 | 210,000 |
| Condensing equipment | 90,000 | 85,000 | 80,000 |
| Total | $414,000 | $417,000 | $437,000 |

Thus the difference in first cost of the plants will be:

$$b - a = \$3,000$$
$$c - b = 20,000$$
$$c - a = 23,000$$

The difference in investment charges and maintenance costs at 15 per cent will be as follows:

$$b - a = 3,000 \times 0.15 = \$450 \text{ per year}$$
$$c - b = 20,000 \times 0.15 = 3,000 \text{ per year}$$
$$c - a = 23,000 \times 0.15 = 3,450 \text{ per year}$$

The curves in Figs. 1, 2 and 3 have been constructed to show the actual decrease in production costs under the different steam conditions considered with different prices of coal and energy output. These curves give evidence that steam at 400-lb. pressure 700 deg. F. is the more advantageous unless coal is very cheap and the capacity factor very low.

### Air Heaters and Economizers Considered

For the reasons stated we shall consider only steam conditions of 400 lb. 700 deg. F. in the following computations and shall investigate whether it is advisable to install air preheaters or economizers, or air preheaters and economizers. We have then the following four cases:

Case I: Three 10,000-kw. turbo-generators.
Four 1,000-hp. boilers with superheaters.

Case II: Three 10,000-kw. turbo-generators.
Four 1,000-hp. boilers with superheaters.
Four air preheaters (assume 10,000 sq.ft. each).

Case III: Three 10,000-kw. turbo-generators.
Four 1,000-hp. boilers with superheaters.
Four economizers (assume 6,000 sq.ft. each).

Case IV: Three 10,000-kw. turbo-generators.
Four 1,000-hp. boilers with superheaters.
Four air preheaters (10,000 sq.ft. each).
Four economizers (6,000 sq.ft. each).

It is generally conceded that it is economical to heat the feed water with steam extracted from the turbines and to use motor-driven auxiliaries. Using this method for feed-water heating, we can proceed to calculate the steam requirements:

*Case I:*

The steam requirements to generate power will be as follows:

8 hours at 7,500 kw. × 9.9 = 74,300 lb. per hour
13 hours at 16,000 kw. × 9.9 = 158,400 lb. per hour
3 hours at 25,000 kw. × 9.9 = 247,500 lb. per hour

The live steam added at throttle for steam extracted to heat feed water to 270 deg. F. will be as follows: 8 hours at 6,000 lb. per hour, 13 hours at 12,850 lb. per hour and 3 hours at 20,000 lb. per hour.

Thus the total steam to the turbine throttle will be:

8 hours at 74,300 plus 6,000 = 80,300 lb. per hour
13 hours at 158,400 plus 12,850 = 171,250 lb. per hour
3 hours at 247,500 plus 20,000 = 267,500 lb. per hour

If 2 per cent is assumed for soot blowers and losses, then the total steam to be generated in the plant will be:

8 hours at 80,300 plus 1,600 = 81,900 lb. per hour
13 hours at 171,250 plus 3,425 = 174,675 lb. per hour
3 hours at 267,500 plus 5,350 = 272,850 lb. per hour

To generate this steam the boilers will probably be operated as follows: 8 hours, two boilers at 136 per cent rating; 13 hours, three boilers at 195 per cent rating, and 3 hours, three boilers at 304 per cent rating.

The efficiencies of the steam-generating units, will be about as follows:

| Rating, Per Cent | Efficiency, Per Cent | Steam Per Pound of Coal |
|---|---|---|
| 150 | 75 | 8.78 |
| 200 | 73 | 8.55 |
| 300 | 70 | 8.2 |

With these efficiencies the coal used per year for Case I will be as follows:

$$365 \times 8 \times \frac{81.900}{8.78} = 27,200,000 \text{ lb.} = 13,600 \text{ tons}$$

$$365 \times 13 \times \frac{174,675}{8.55} = 97,000,000 \text{ lb.} = 48,500 \text{ tons}$$

$$365 \times 3 \times \frac{272,850}{8.2} = 36,500,000 \text{ lb.} = 18,250 \text{ tons}$$

$$\text{Total} = 80,350 \text{ tons}$$

*Case II:*

The steam to be generated is the same as in Case I, the efficiencies of the steam-generating units will be about:

| Rating, Per Cent | Efficiency, Per Cent | Steam per Pound of Coal |
|---|---|---|
| 150 | 81 | 9.48 |
| 200 | 79 | 9.24 |
| 300 | 77 | 9.0 |

The coal used per year with these efficiencies will be:

$$365 \times 8 \times \frac{81,900}{9.48} = 25,200,000 \text{ lb.} = 12,600 \text{ tons}$$

$$365 \times 13 \times \frac{174,675}{9.24} = 89,800,000 \text{ lb.} = 44,900 \text{ tons}$$

$$365 \times 3 \times \frac{272,850}{9.0} = 33,200,000 \text{ lb.} = 16,600 \text{ tons}$$

$$\text{Total} = 74,100 \text{ tons}$$

*Case III:*

Steam requirements to generate power:

8 hours at 7,500 kw. × 9.9 = 74,300 lb. per hour
13 hours at 16,000 kw. × 9.9 = 158,400 lb. per hour.
3 hours at 25,000 kw. × 9.9 = 247,500 lb. per hour

Live steam added at the throttle for steam extracted to heat feed water to 210 deg. F. will be:

8 hours at 3,250 lb. per hour, 13 hours at 7,000 lb. per hour and 3 hours at 10,800 lb. per hour.

The total steam to the turbine will then be:

8 hours at 74,300 plus 3,250 = 77,550 lb. per hour
13 hours at 158,400 plus 7,000 = 165,400 lb. per hour
3 hours at 247,500 plus 10,800 = 258,300 lb. per hour

Adding 2 per cent for soot blowers and losses, then the total steam to be generated will be:

8 hours at 77,500 plus 1,550 = 79,100 lb. per hour
13 hours at 165,400 plus 3,300 = 168,700 lb. per hour
3 hours at 258,300 plus 5,160 = 263,460 lb. per hour

The efficiencies of the steam-generating units will be about:

| Rating, Per Cent | Efficiency, Per Cent | Steam Per Pound of Coal |
|---|---|---|
| 150 | 83 | 9.22 |
| 200 | 81 | 8.99 |
| 300 | 79 | 8.77 |

The coal used per year will therefore be:

$$365 \times 8 \times \frac{79,100}{9.22} = 25,050,000 \text{ lb.} = 12,525 \text{ tons}$$

$$365 \times 13 \times \frac{168,700}{8.99} = 89,000,000 \text{ lb.} = 44,500 \text{ tons}$$

$$365 \times 3 \times \frac{263,460}{8.77} = 32,800,000 \text{ lb.} = 16,400 \text{ tons}$$

$$\text{Total} = 73,425 \text{ tons}$$

*Case IV:*

The steam to be generated is the same as in Case III; the efficiencies of the steam-generating units will be:

| Rating, Per Cent | Efficiency, Per Cent | Steam Per Pound of Coal |
|---|---|---|
| 150 | 86 | 9.54 |
| 200 | 84 | 9.32 |
| 300 | 82 | 9.1 |

The coal used per year will then be:

$$365 \times 8 \times \frac{79{,}100}{9.54} = 24{,}200{,}000 \text{ lb.} = 12{,}100 \text{ tons}$$

$$365 \times 13 \times \frac{168{,}700}{9.32} = 86{,}000{,}000 \text{ lb.} = 43{,}000 \text{ tons}$$

$$365 \times 3 \times \frac{263{,}460}{9.1} = 31{,}700{,}000 \text{ lb.} = 15{,}850 \text{ tons}$$

Besides the equipment which the plants in the four cases have in common, Case I has three high-pressure closed heaters; Case II has three high-pressure closed heaters, four air preheaters and larger fans and motors; Case III has four economizers and larger fans and motors; Case IV has four economizers, four air preheaters and larger fans and motors.

To house the power plant equipment for the four cases, the turbine room will be the same size in each case, but the size of the boiler room will vary about as follows:

Case I: $150 \times 55 \times 50 = 412{,}500$ cu.ft.
Case II: $150 \times 65 \times 50 = 487{,}500$ cu.ft.
Case III: $150 \times 65 \times 50 = 487{,}500$ cu.ft.
Case IV: $150 \times 65 \times 50 = 487{,}500$ cu.ft.

## Comparative Costs of Plants

The first cost of the power plant in each of these four cases will be a constant, $C$, plus an amount depending on each installation:

| Case I costs: | $C$ |
|---|---|
| Three bleeder heaters with piping | $10,000 |
| | $C$ plus $10,000 |
| Engineering and construction, 25 per cent | 0.25 ($C$ plus 10,000) |
| Total | 1.25 ($C$ plus $10,000) |

| Case II costs: | $C$ |
|---|---|
| Three bleeder heaters with piping | $10,000 |
| Four air preheaters | 40,000 |
| Ductwork for air preheaters and insulation | 10,000 |
| Extra for larger fans and motors | 3,000 |
| Extra for larger building | 22,500 |
| | $C$ plus $85,500 |
| Engineering and construction, 25 per cent | 0.25 ($C$ plus 85,500) |
| Total | 1.25 ($C$ plus $85,500) |

| Case III costs: | $C$ |
|---|---|
| Four economizers | $70,000 |
| Extra for larger fans and motors | 2,000 |
| Extra for larger building | 22,500 |
| | $C$ plus $94,500 |
| Engineering and construction, 25 per cent | 0.25 ($C$ plus 94,500) |
| Total | 1.25 ($C$ plus $94,500) |

| Case IV costs: | $C$ |
|---|---|
| Four economizers | $70,000 |
| Four air preheaters | 40,000 |
| Duct work for air preheater and insulation | 10,000 |
| Extra for larger fans and motors | 4,000 |
| Extra for larger building | 22,500 |
| | $C$ plus $146,500 |
| Engineering and construction, 25 per cent | 0.25 ($C$ plus 146,500) |
| Total | 1.25 ($C$ plus $146,500) |

In all probability the same number of operators and laborers will be required to operate the power plant in each of the four cases. The maintenance cost, however, will vary.

If $M$ is the maintenance cost on the equipment, which all cases have in common, then the maintenance costs will be:

Case I: $M$ plus $300
Case II: $M$ plus $2,500
Case III: $M$ plus $3,000
Case IV: $M$ plus $4,500

The difference in energy required for auxiliaries depends principally on the loads on the forced and induced draft fans. The energy required for these fans will be:

Case I, Induced Draft Fans:
8 hours, two fans at 30 kw. = 480 kw.-hr.
13 hours, three fans at 45 kw. = 1,760 kw.-hr.
3 hours, three fans at 60 kw. = 540 kw.-hr.

Forced Draft Fans:
8 hours, two fans at 30 kw. = 480 kw.-hr.
13 hours, three fans at 40 kw. = 1,560 kw.-hr.
3 hours, three fans at 50 kw. = 450 kw.-hr.

5,270 kw.-hr. per day

Case II, Induced Draft Fans:
8 hours, two fans at 70 kw. = 1,120 kw.-hr.
13 hours, three fans at 85 kw. = 3,320 kw.-hr.
3 hours, three fans at 100 kw. = 900 kw.-hr.

Forced Draft Fans:
8 hours, two fans at 45 kw. = 720 kw.-hr.
13 hours, three fans at 55 kw. = 2,150 kw.-hr.
3 hours, three fans at 75 kw. = 675 kw.-hr.

8,885 kw.-hr. per day

Case III, Induced Draft Fans:
8 hours, two fans at 70 kw. = 1,120 kw.-hr.
13 hours, three fans at 85 kw. = 3,320 kw.-hr.
3 hours, three fans at 100 kw. = 900 kw.-hr.

Forced Draft Fans:
8 hours two fans at 30 kw. = 480 kw.-hr.
13 hours, three fans at 40 kw. = 1,560 kw.-hr.
3 hours, three fans at 50 kw. = 450 kw.-hr.

6,830 kw.-hr. per day

Case IV, Induced Draft Fans:
8 hours, two fans at 95 kw. = 1,520 kw.-hr.
13 hours, three fans at 110 kw. = 4,290 kw.-hr.
3 hours, three fans at 150 kw. = 1,350 kw.-hr.

Forced Draft Fans:
8 hours, two fans at 45 kw. = 720 kw.-hr.
13 hours, three fans at 55 kw. = 2,150 kw.-hr.
3 hours, three fans at 75 kw. = 675 kw.-hr.

10,705 kw.-hr. per day

If $E$ is the coal required per year to generate the auxiliary power for Case I, then the auxiliary power for the other cases requires:

Case II:
$E$ plus $(3{,}615 \times 1.25 \times 365) \div 2{,}000 = E$ plus 825 tons of coal
Case III:
$E$ plus $(1{,}560 \times 1.25 \times 365) \div 2{,}000 = E$ plus 356 tons of coal
Case IV:
$E$ plus $(5{,}435 \times 1.25 \times 365) \div 2{,}000 = E$ plus 1,240 tons of coal

The total coal consumed exclusive of banking will then be:

Case I: 80,350 plus $E$ plus 0 = $E$ plus 80,350 tons per year
Case II: 74,100 plus $E$ plus 825 = $E$ plus 74,925 tons per year
Case III: 73,425 plus $E$ plus 356 = $E$ plus 73,781 tons per year
Case IV: 70,950 plus $E$ plus 1,240 = $E$ plus 72,190 tons per year

The fixed charges on the power plant installation will include interest on the investment, depreciation, taxes and insurance and will probably form an annual charge of 13 per cent on the money invested. The fixed charges in the four cases will then be:

Case I: 1.25 ($C$ plus 10,000) × 0.13
Case II: 1.25 ($C$ plus 85,500) × 0.13
Case III: 1.25 ($C$ plus 94,500) × 0.13
Case IV: 1.25 ($C$ plus 146,500) × 0.13

The total production costs consist of the following principal items: (*a*) fuel, (*b*) maintenance and supplies, (*c*) labor, (*d*) fixed charges.

The total production costs will therefore be:

Case I: (*a*) ($E$ + 80,350) tons of coal, (*b*) ($M$ + 300) dollars, (*c*) L, (*d*) 1.25 ($C$ + 10,000) 0.13 dollars. Total, constant $K$ + 1,925 dollars + 80,350 tons of coal.

Case II: (*a*) ($E$ + 74,925) tons of coal, (*b*) ($M$ +

2,500) dollars, (*c*) *L*, (*d*) 1.25(*C* + 85,500) 0.13 dollars. Total, constant *K* + 16,400 dollars + 74,925 tons of coal.

Case III: (*a*) (*E* + 73,781) tons of coal, (*b*) (*M* + 3,000) dollars, (*c*) *L*, (*d*) 1.25(*C* + 94,500) 0.13 dollars. Total, constant *K* + 18,350 dollars + 73,781 tons of coal.

Case IV: (*a*) (*E* + 72,190) tons of coal, (*b*) (*M* + 4,500) dollars, (*c*) *L*, (*d*) 1.25(*C* + 146,500) 0.13 dollars. Total, constant *K* + 28,300 dollars + 72,190 tons of coal.

The difference in production costs of these plants for various coal prices, is given in the following table, which shows these costs above constant *K*:

| Price of Coal... | $1 | $2 | $3 | $4 | $5 | $6 | $7 |
|---|---|---|---|---|---|---|---|
| Case I.. | $82,275 | $162,625 | $242,975 | $323,325 | $403,675 | $484,025 | $564,375 |
| Case II | 91,325 | 166,250 | 241,175 | 316,100 | 391,025 | 465,950 | 540,875 |
| Case III. | 92,131 | 165,912 | 239,693 | 313,474 | 387,255 | 461,036 | 534,817 |
| Case IV. | 100,490 | 172,680 | 244,870 | 317,060 | 389,250 | 461,440 | 533,630 |

The difference in production costs with various fuel prices is shown in graphical form in Fig. 4. All the foregoing calculations are based on an annual output of 125,000,000 kw.-hr., which for the size plant under consideration is about a 50 per cent capacity factor. In order to ascertain what the difference in production costs would be with a 25 per cent capacity factor, the graphs in Fig. 5 have been prepared.

## Stokers or Pulverized Fuel

Consider now whether it is advisable to install stokers or pulverized coal equipment for these four boilers. The opinion has often been expressed that burning coal in pulverized form will produce much higher efficiency than when burned on stokers. The results obtained with stoker-fired installations at the plants of the Brooklyn Edison Company, the Philadelphia Electric Company and at Hellgate show, however, that practically just as good results can be obtained with stoker-fired boilers as with pulverized coal. The heat balances for both kinds of firing show that the losses are about the same except that the stoker-fired boilers show more ashpit losses. These ashpit losses run especially high when the boilers are forced to high ratings. On account of these ashpit losses, we shall credit the pulverized fuel-fired boilers with 3 per cent less fuel consumption in the following calculations.

Comparing power plants built recently, we find that the boiler room of the bin-type pulverized-coal plant exceeds the boiler room of the stoker-fired plant about 20 ft. in height. The combustion chamber of the pulverized coal-fired boiler is also considerably larger than the combustion chamber of the stoker-fired boiler. The building and the boiler settings of the pulverized-coal plant will therefore be more expensive than those of the stoker-fired plant.

Since difference in cost will all be in the boiler house, we shall compare these costs only. The cost of the boiler house for the pulverized coal plant will be:

| | |
|---|---|
| Boiler house, building | $245,000 |
| Pulverized-fuel equipment (no driers) | 100,000 |
| Boilers and superheaters | 130,000 |
| Boiler settings | 85,000 |
| Fans and motors | 18,000 |
| Ash-removal equipment | 15,000 |
| Steel-plate work | 30,000 |
| Miscellaneous equipment | 130,000 |
| Total | $753,000 |

The cost of the boiler room for the stoker-fired plant will be:

| | |
|---|---|
| Boiler house, building | $195,000 |
| Underfeed stokers | 80,000 |
| Boilers and superheaters | 130,000 |
| Boiler settings | 55,000 |
| Fans and motors | 30,000 |
| Ash-removal equipment | 15,000 |
| Steel-plate work | 25,000 |
| Miscellaneous equipment | 125,000 |
| Total | $655,000 |

The pulverized-coal plant will thus cost $98,000 more than the stoker-fired plant, exclusive of engineering and construction charges.

The labor for the boiler room of the pulverized-coal plant will be as follows:

| | Per Month |
|---|---|
| Firemen, three at $160 | $480 |
| Boiler-room helpers, three at $125 | 375 |
| Coal-handling men, three at $125 | 375 |
| Coal-preparation men, four at $145 | 580 |
| Fan men, three at $145 | 435 |
| Locomotive crane engineer | 200 |
| Locomotive crane fireman | 160 |
| Ash man | 125 |
| Superintendence | 300 |
| | $3,030 |
| Or, per year | $36,360 |

The labor for the boiler room of the stoker-fired plant will be:

| | Per Month |
|---|---|
| Firemen, three at $160 | $480 |
| Assistant firemen, three at $195 | 435 |
| Boiler-room helpers, three at $125 | 375 |
| Coal-handling men, three at $125 | 375 |
| Ash men, two at $125 | 250 |
| Fan men, three at $145 | 435 |
| Locomotive crane engineer | 200 |
| Locomotive crane fireman | 160 |
| Superintendence | 300 |
| | $3,010 |
| Or per year | $36,120 |

In accordance with published results, obtained in modern plants of recent date, the annual charges for maintenance and supplies for the pulverized coal plant will be:

| | |
|---|---|
| Pulverized-fuel equipment | $7,500 |
| Boiler settings | 8,500 |
| Fans and motors | 900 |
| Ash-removal equipment | 750 |
| Miscellaneous equipment | 4,000 |
| Total | $21,650 |

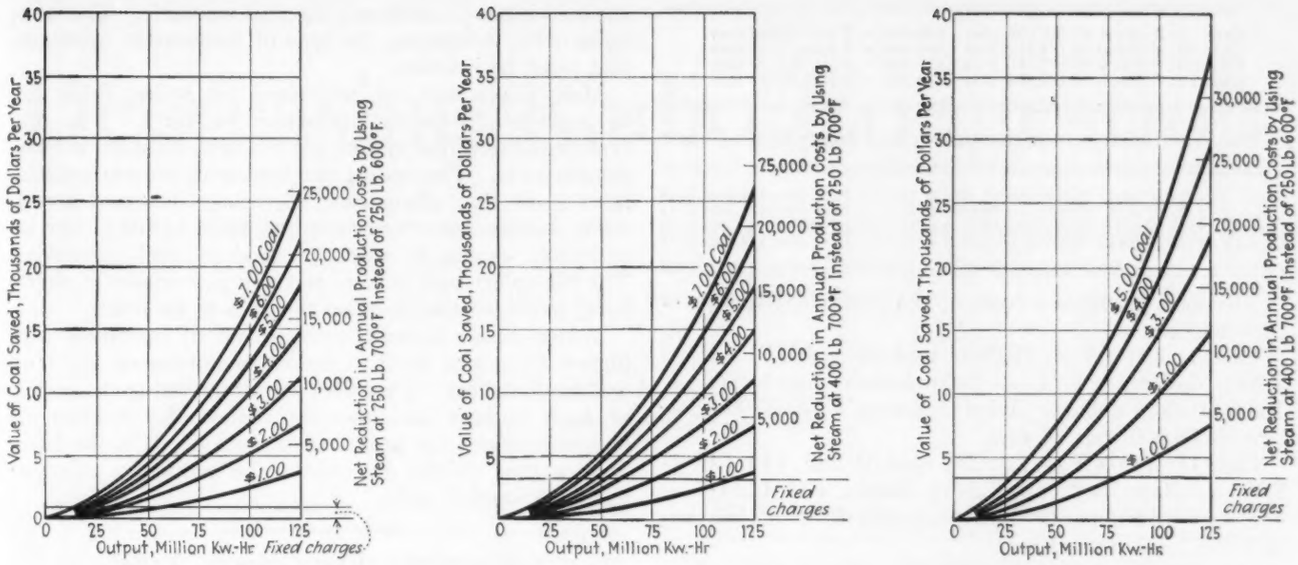
The annual charges for maintenance and supplies for the stoker-fired plant will be:

| | |
|---|---|
| Stokers | $7,500 |
| Boiler settings | 5,500 |
| Fans and motors | 1,500 |
| Ash-removal equipment | 1,500 |
| Miscellaneous equipment | 3,750 |
| Total | $18,750 |

The maintenance costs for the pulverized-coal plants are, therefore, $2,900 per year more than the maintenance costs of the stoker-fired plant.

The maintenance of the pulverized-coal plant is then:

Case I: (*M* plus 300 plus 2,900) = *M* plus 3,200
Case II: (*M* plus 2,500 plus 2,900) = *M* plus 5,400
Case III: (*M* plus 3,000 plus 2,900) = *M* plus 5,900
Case IV: (*M* plus 4,500 plus 2,900) = *M* plus 7,400




FIGS. 1, 2 AND 3—NET ECONOMY IN ANNUAL PRODUCTION COSTS EFFECTED BY DIFFERENT COMBINATIONS OF STEAM PRESSURE AND TEMPERATURE AT DIFFERENT YEARLY OUTPUTS

The energy required for auxiliaries in the boiler room of the pulverized-coal plant will be:

| | Case I | Case II | Case III | Case IV |
|---|---|---|---|---|
| Fans | 1,520,000 | 3,100,000 | 2,500,000 | 3,950,000 |
| Pulverized-fuel equipment | 1,950,000 | 1,800,000 | 1,770,000 | 1,730,000 |
| Coal handling | 80,000 | 75,000 | 75,000 | 72,000 |
| Total kw.-hr. per year | 3,550,000 | 4,975,000 | 4,345,000 | 5,752,000 |

The coal used to generate this energy will be: Case I, 2,200 tons; Case II, 3,100 tons; Case III, 2,700 tons; Case IV, 3,600 tons.

The energy required for auxiliaries in the boiler room of the stoker-fired plant will be:

| | Case I | Case II | Case III | Case IV |
|---|---|---|---|---|
| Fans and stokers | 2,000,000 | 3,200,000 | 2,600,000 | 4,050,000 |
| Coal handling | 85,000 | 80,000 | 80,000 | 75,000 |
| Total kw.-hr. per year | 2,085,000 | 3,280,000 | 2,680,000 | 4,125,000 |

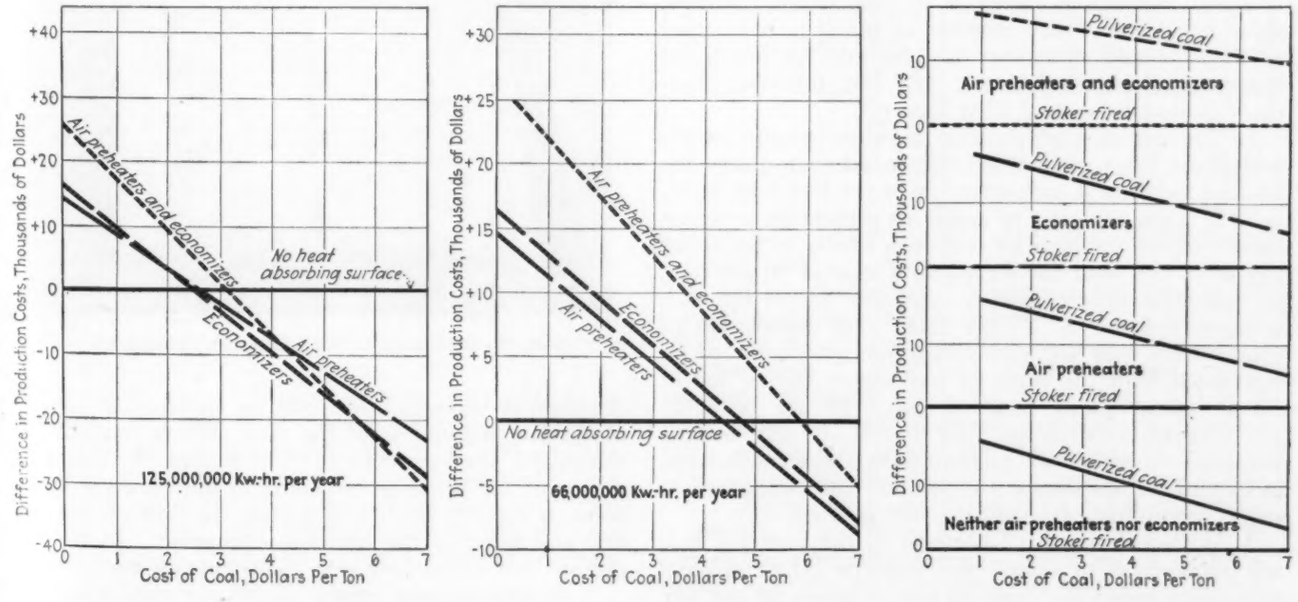
The coal used to generate this energy will be: Case I, 1,300 tons; Case II, 2,050 tons; Case III, 1,670 tons; Case IV, 2,580 tons.

The coal used for starting pulverized-coal furnaces will be about 200 tons per year, while the coal used for banking stoker-fired furnaces will be about 1,000 tons per year.

The coal used per year by the stoker-fired plant will be:

Case I: $E$ plus 80,350 tons
Case II: $E$ plus 74,925 tons
Case III: $E$ plus 73,781 tons
Case IV: $E$ plus 72,190 tons

The coal used per year by the pulverized coal plant will be:




FIGS. 4, 5 AND 6—ECONOMY OF HEAT-ABSORBING SURFACE IN FLUE GASES AT TWO CAPACITY FACTORS AND RELATIVE ECONOMY OF STOKERS AND PULVERIZED FUEL BASED ON PRODUCTION COSTS AND FUEL PRICES

Case I: $E$ plus 0.97 (80,350) plus 920–800 = $E$ plus 78,060 tons
Case II: $E$ plus 0.97 (74,925) plus 1,050–800 = $E$ plus 72,927 tons
Case III: $E$ plus 0.97 (73,781) plus 1,030–800 = $E$ plus 71,797 tons
Case IV: $E$ plus 0.97 (72,190) plus 1,020–800 = $E$ plus 70,244 tons

The fixed charges on the pulverized-coal plant will be:

Case I: 1.25 ($C$ plus 10,000 plus 98,000) 0.13 = 1.25 ($C$ plus 108,000) 0.13
Case II: 1.25 ($C$ plus 85,500 plus 98,000) 0.13 = 1.25 ($C$ plus 183,500) 0.13
Case III: 1.25 ($C$ plus 94,500 plus 98,000) 0.13 = 1.25 ($C$ plus 192,500) 0.13
Case IV: 1.25 ($C$ plus 146,500 plus 98,000) 0.13 = 1.25 ($C$ plus 244,500) 0.13

The total production costs of the pulverized-fuel plant then will be:

Case I: ($a$) ($E$ + 78,060) tons of coal, ($b$) ($M$ + 3,200) dollars, ($c$) ($L$ + 240) dollars, ($d$) 1.25($C$ + 108,000) 0.13 dollars. Total, constant $K$ + 20,990 dollars + 78,060 tons of coal.

Case II: ($a$) ($E$ + 72,927) tons of coal, ($b$) ($M$ + 5,400) dollars, ($c$) ($L$ + 240) dollars, ($d$) 1.25($C$ + 183,500) 0.13 dollars. Total, constant $K$ + 35,480 dollars + 72,927 tons of coal.

Case III: ($a$) ($E$ + 71,979) tons of coal, ($b$) ($M$ + 5,900) dollars, ($c$) (L + 240) dollars, ($d$) 1.25($C$ + 192,500) 0.13 dollars. Total, constant $K$ + 37,400 dollars + 71,927 tons of coal.

Case IV: ($a$) ($E$ + 70,244) tons of coal, ($b$) ($M$ + 7,400) dollars, ($c$) ($L$ + 240) dollars, ($d$) 1.25($C$ + 244,500) 0.13 dollars. Total, constant $K$ + 47,440 dollars + 70,244 tons of coal.

The difference in production costs of these plants with pulverized fuel, for various coal prices, is given in the following table, which shows these costs above constant $K$:

| Price of Coal | $1 | $2 | $3 | $4 | $5 | $6 | $7 |
|---|---|---|---|---|---|---|---|
| Case I..... | 99,050 | 177,110 | 255,170 | 333,230 | 411,290 | 489,350 | 567,410 |
| Case II..... | 108,407 | 181,334 | 254,261 | 327,188 | 400,115 | 473,044 | 545,969 |
| Case III..... | 109,197 | 180,994 | 252,791 | 324,588 | 396,385 | 468,182 | 539,980 |
| Case IV..... | 117,684 | 187,928 | 258.172 | 328,416 | 398,660 | 468,904 | 539,148 |

The difference in production costs between stoker-fired and pulverized coal-fired boilers, with various coal prices for each of the four cases, is shown in graphical form in Fig. 6.

These calculations, fitted to a medium-sized station, show in a general way whether or not it is economical to install costly equipment for the sake of increasing the over-all plant efficiency, and the following conclusions may be drawn from them:

1. The use of high-pressure high-temperature steam will show large returns on the investment unless the load on the plant is extremely low or the fuel very cheap.

2. It is not advisable to install air preheaters or economizers unless the price of coal is in excess of $2.50 per ton when the plant has a capacity factor of 50 per cent, or unless the price of coal is more than $4 per ton with a capacity factor of 25 per cent. The installation of economizers and air preheaters does not seem to be warranted with the price of coal below $6 per ton at 50 per cent capacity factor or below $9 per ton at 25 per cent capacity factor. Of course, it may become necessary to install air preheaters to assist combustion, as experience has shown that certain coals can be burned more successfully if preheated air is used.

3. With a saving of 3 per cent in the fuel bill, it is not economical to install the bin-type pulverized-coal equipment unless the price of coal is about $9 per ton.

As mentioned before, each power plant should be designed to suit the conditions at which it must be operated, the load it has to carry and the fuel available. The latter quite often determines the type of combustion apparatus that must be installed.

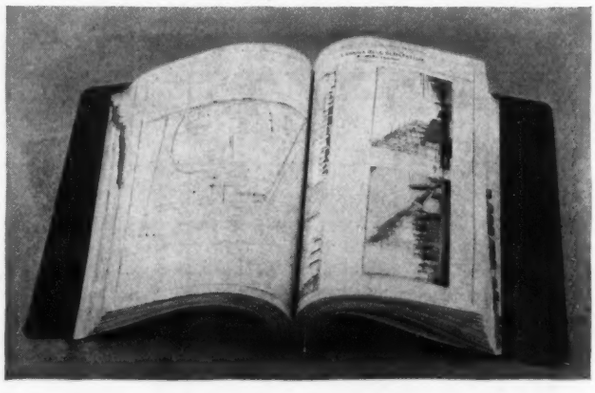
Many coals that are not suited for stoker firing can be successfully burned in pulverized form. The unit type pulverized-coal system has not been included in these comparisons. The results obtained with present installations show that efficiencies, operating costs and investment charges are very nearly the same as for stoker installation, except in cases of unusual coal conditions. The choice between stokers and unit pulverizers is, therefore, mostly determined by the fuel to be used.

Water-cooled furnace walls permit of operating with higher $CO_2$ and tend to reduce maintenance costs on walls and stokers. They also permit operating the boilers at high ratings and thereby reduce the number of boilers required for peak load operation. It is the latter faculty that chiefly determines the economic value of the water-cooled walls.

## Property Data Book Aids Operating Staff

THE use of a property data book listing all generating and substation equipment on the system of the Southern California Edison Company has been found to be of great value, particularly to the operating organization. The book is of standard 8½x11-in. size, bound in a loose-leaf leather binder and contains about 450 pages of maps, diagrams, pictures and tabulations printed on heavy white glazed stock, thumb-indexed.

The system used in compiling the book was to divide the material into three general classes; a map section, with a key map dividing the territory served into 31 sections, and individual maps of each section, showing power plants, substations and consumers' substations; a miscellaneous section, giving the symbols used throughout the book, typical schematic drawings of switch racks and elevations, and plans of substations for the standard



PROPERTY DATA BOOK OFFERS COMPLETE SYSTEM RECORD

distribution voltages used; and an alphabetical section, comprising non-tenths of the book, which contains exterior and interior views of each station or substation, a map of the property belonging to the company at the point, a colored single-line wiring diagram of the station and a list of the electrical equipment. In all, 208 stations and substations are covered in this manner.

A department was created within the engineering department to compile the data book and to keep it up to date.

# Decreasing Radio Congestion

Single side-band transmission offered as a means of increasing number of transmitting stations without interference augmentation. Transmitting filters involved in plan following proved principles

By R. D. Duncan, Jr.
*Chief Engineer Wired Radio, Inc.*

MAINLY as an extension of the engineering development of wired radio broadcasting, the possibilities of side-band suppression, both at the transmitter and at the receiver, and the utilization of the carrier frequency and only one side band, in the range of frequencies employed in space radio broadcasting, have been investigated both theoretically and experimentally. The results confirm those obtained at the lower wired radio frequencies and indicate that by introducing changes in at least some of the existing space radio transmitting apparatus the frequency displacement between transmitting stations may be reduced from what it now is. The recommendations given herein are not put forth as a cure-all for present broadcasting ills. Instead, they are suggestions of a means which experiment has demonstrated to be of great practical value at the lower frequencies, both in broadcasting and in the general field of carrier communication, for partially alleviating the present state of frequency congestion. Filter circuits for side-band suppression have been used for several years in long-distance carrier-current telephony. In accordance with published reports they are also employed in the transatlantic radio telephone link. Space radio broadcasting should avail itself of the advantages offered by such improvements. The object of this article is to direct attention to the advantages and possibilities which would accompany the use of single side-band (and carrier) transmission in space radio broadcasting as compared with double side-band transmission now employed.

In the system of broadcasting by wired radio over electric light and power lines, developed by Wired Radio, Inc., because of the restrictions imposed by attenuation and general power loss on the lines, and of the requirement of high quality fundamental to broadcasting, the frequencies available for transmission are restricted to the range of approximately 25 to 70 kilocycles. As the program requirements demand three distinct channels, each with the proper frequency band, the working conditions which had to be met required operating as a minimum three closely associated transmitting stations within a frequency range of 45 kilocycles, and into the same load, viz., the line system. This latter would correspond in space radio to more than one transmitter operating into the same antenna. From the receiver standpoint there could be no cross-talk between channels or beat interference between carriers.

The problem was solved by the use of carrier and single side-band transmission in combination with master oscillator-driven transmitters. The former restricted the frequency range of each channel and the latter fixed the carrier frequencies of all channels. Single side-band transmission was obtained by the use of band frequency filter circuits at both the transmitter and receiver.

There is apparently no fundamental reason why single side-band operation would not be equally effective at space radio broadcast frequencies. When it is considered that three wired radio channels are operated on the same wire system within a frequency band of approximately 45 kilocycles, whereas a frequency displacement is space radio between individual broadcast transmitters, geographically within a range of 50 miles of one another,

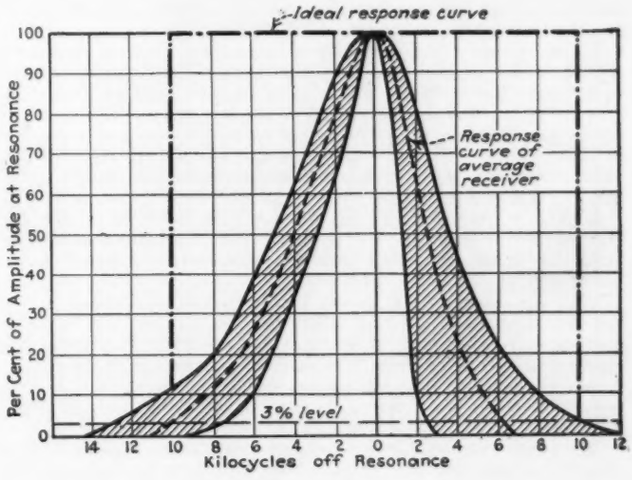



FIG. 1—FREQUENCY-RESPONSE CURVES OF BROADCAST RECEIVERS

is of the order of 50 kilocycles, the apparent advantages of such a system in the way of permitting the operation of an increased number of transmitting stations in the present frequency range are manifest.

Suggestions have been made from time to time as to the advantages of some form of synchronized or fixed frequency transmitter operation obtained by the use of harmonics of a master frequency and with the assistance of the piezo-electric crystal, for the purpose of eliminating indiscriminate fluctuation of the different transmitter carrier frequencies. Undoubtedly, improvements in this respect will be introduced regardless of the direction of other improvements or changes. Single side-band transmission, with the great advantage of conserving the frequencies required per transmitter, though known in theory and employed in other fields, for some reason has not received the use in space radio broadcasting which is merited.

The methods of single side-band transmission and reception may be better understood if a statement is made of some of the fundamental concepts of radio telephone operation when amplitude modulation is employed. These are as follows:

1. During modulation the current in the transmitting antenna consists of a series of discrete frequencies which normally extend above and below the carrier frequency; the latter is the only frequency present when not modulating.

2. The frequencies lower than the carrier are known as the lower side-band and those higher as the upper side-band frequencies. The frequency extent of the upper and the lower side bands is determined, among other factors, by the upper audio frequency limit of the modulating source.

3. The amplitudes of the side-band currents are determined principally by the degree of modulation and the impedance of the transmitting antenna at the particular frequency. Their maximum possible value with 100 per cent modulation is 50 per cent of that of the carrier frequency. Under operating conditions the average modulation is considerably less than 100 per cent and the side-band currents are correspondingly reduced in amplitude.

4. If the transmitting antenna is too sharply tuned; that is, if its impedance at the side-band frequencies is considerably greater than its resistance effective at the carrier frequency, the extreme upper and lower side-band frequency currents will be greatly reduced in amplitude, if not entirely suppressed. This is equivalent to the condition of absence of the higher audio frequency currents in the modulating source.

5. For perfect musical reproduction it is commonly accepted that an audible frequency range up to 10,000 cycles per second is required.

6. As a result of a wave impinging upon the receiving antenna or loop, a series of voltages corresponding to the carrier and different side-band frequencies is impressed upon the grid of the detector tube. The relative amplitudes of these voltages are determined by the frequency responsive qualities of the radio frequency amplifying circuits of the receiver.

7. By virtue of the rectifying action of the detector the interaction of the carrier frequency and each side frequency of the upper and lower bands produces a desired audible frequency current component in the detector output circuit. The pairs of component currents which have the same frequency add directly in their effect upon the audio frequency amplifier. One of the pairs, however, may be suppressed without affecting the quality of the audio response.

8. The suppression of one of the side bands at either the transmitter or receiver, or at both, will eliminate one of the pairs of audio frequency current components referred to in paragraph 7.

9. The presence of a second carrier frequency voltage at the detector input will interact with the first carrier and with its side-band frequencies to produce additional lower beat frequency components. The latter will be audible, providing that the difference frequency between the second carrier and the different components in the original frequency band is audible and is sufficiently amplified by the audio frequency amplifier of the receiver.

10. If the second carrier is itself modulated, still lower frequency components are produced in the detector output which further complicate reception.

11. The relative intensities of the two carrier frequency voltages, with their side bands, at the detector input are determined by the frequency responsive properties of the receiver and the field strengths of the two carriers at the receiving antenna.

From this brief analysis it is seen that the allocation of transmitting frequencies is governed, first, by the requirement of no audible beating between carrier frequencies, and, second, to a large extent, by the frequency-selectivity properties of the receiver. Since only the carrier and one side band are required at the receiver (of present types) for faithful reproduction, it is obvious that if one set of side bands of each transmitter were suppressed the frequency displacement between transmitting stations could be decreased from what it now is. The limit imposed in approaching the frequency bands of two transmitters to the point where the side-band frequencies or the carriers of the two stations produce audible beating is the frequency responsive properties of the average receiver.

Typical frequency response curves for a number of standard types of broadcast receivers are given in Fig. 1. These include single-control tuned radio-frequency amplifier sets, with and without the neutrodyne feature, the super-heterodyne type of receiver and sets with both battery and alternating-current source of tube power. The ordinates represent the ratio of voltage developed at the detector grid to the voltage applied at the input of the receiver, as a per cent of the maximum occurring at the frequency for which the set is tuned; the abscissas are kilocycles off the resonant frequency, which in this case was approximately 610 kilocycles. The shaded area in which all the curves lie accounts for the difference between sets, the dissymmetry in response for frequencies higher and lower than the resonant frequency, and for different conditions of signal volume gain for a given set. The ideal response curve for 10 kilocycles above and below the resonant frequency is shown in heavy line. The departure of the average receiver within its band pass range, from the ideal flat top response, is to be noted and would indicate a suppression of the higher audio frequencies.

Similar curves are obtained as the resonant frequency is increased, becoming considerably broader, however. At the very high frequencies the top may extend over 50 kilocycles. The latter condition leads to cross-talk interference and is a fault of some of the present types of receivers.

### Experiments Indicate Applicability of Plan

By experiment, it is known that if two transmitters produce equal field strengths at a receiving antenna, and there is to be no observable cross-talk, with the average receiver, the undesired signal voltage at the detector input must not exceed from 1 per cent to 5 per cent of the desired signal. Adopting 3 per cent as an average, it is seen from the accompanying illustration that with the worst possible conditions the frequency band of the receiver is approximately 25 kilocycles. The average receiver, shown in dashed line, gives a minimum 3 per cent response over a band of 17 kilocycles.

The present frequency displacement between transmitters in the New York City area in the range 610 to 760 kilocycles is shown graphically in Fig. 2a, for double side-band transmission, and assuming a side band extent of 10 kilocycles. Four transmitters are shown. The positions occupied by receivers of 30 and 20 kilocycle bands are also shown. In Figs 2b and c are shown two possible frequency arrangements with single side-band suppression at the transmitter. In the former all carriers are displaced 30 kilocycles and the upper side bands are suppressed. In the latter the carriers are alternately displaced 20 and 40 kilocycles and in alternate transmitters the upper and lower side bands are suppressed. The positions of receivers for the two conditions indicate that there will be no inter-transmitter interference. The arrangement of Fig. 2b and c permits of a 50 per cent increase in the number of transmitters in the same frequency range, with 10 kilocycles to spare.

By incorporating corresponding changes in the receivers; that is, by improving their frequency cut-off properties without, however, sharpening their response within the band pass range which may be accomplished by means of filters, a still closer grouping of transmitters is possible. The arrangement of Fig. 2d shows an alternate 15- and 30-kilocycle displacement between carriers and an alternate suppression of upper and lower side bands at the transmitters with receivers with a 14-kilocycle response. The transmitting stations in the same frequency range are double those in Fig. 2a.

Transmission and utilization of the carrier and only one side band is accomplished by means of band frequency filter circuits at the transmitter, or at both the transmitter and receiver. Considerable success has been had in the use of the coupled circuit type of filter,* as distinct from the so-called ladder type, for both low and high frequencies.

Several questions arise at this point. Is it practically possible to obtain the necessary cut-off required for side-band suppression with filters which are to be employed at the transmitter? Are they elaborate and costly and how would they be installed? May filters be employed over the entire frequency range now used in broadcasting? Is it practically possible to operate carrier frequencies at intervals of the order of 15 kilocycles with the exactitude which would be demanded by such a system?

### Transmitting Filters Essential

Transmitting filters have been constructed and operated at frequencies in the neighborhood of 610 kilocycles which have a 90 per cent amplitude cut-off with a 0.25 per cent change in frequency. Such a cut-off will give satisfactory single side-band operation. Filters of improved design are under construction with which a much sharper cut-off is expected. The filters need not be complex or costly. A desirable method of installation, where high powers are involved, appears to be that popularly known as the master oscillator-power amplifier system, wherein the unmodulated master frequency is supplied to an intermediate power amplifier where it is modulated by the audio frequencies. The output of this amplifier is fed into the transmitting filter where one side band is suppressed and the carrier and remaining side band supplied to the final power amplifier, which operates into the transmitting antenna. For the lower power stations the transmitting filter could be operated between the oscillator-modulator and the antenna.

It is not possible at the present writing to state definitely the frequency limit with which practical filter operation appears possible. As the frequency is increased the design of the filter has to be made with greater precision and more care is required in its construction and operation. There is apparently no reason, however, why satisfactory filter operation would not be obtained for frequencies of the order of 1,000 kilocycles. By throwing open the frequency range lower than 500 kilocycles for broadcasting the full benefit of filter circuit operation could be realized.

A 15-kilocycle or similar order master frequency could be generated and harmonics thereof supplied to the different transmitters within the same area. Theoretical consideration indicates that as long as the distances between the master generator of the harmonic-operated transmitters are not great, difficulties due to difference in phase and phase shift may not be expected. The supply of master frequencies to the different communities could well be a governmental function.

Successful multi-channel wired radio broadcasting has been obtained with comparatively simple terminal equipment, with a 17-kilocycle displacement between carriers and by means of single side-band transmission. Filters were employed in both the transmitting and receiving apparatus.

*The mathematical theory of such circuits has been given by L. Cohen, *Journal of the Franklin Institute*, page 641, May, 1923.

The close operation in frequency of transmitters was a fundamental problem in wired radio broadcasting and it was solved by considering the transmitting and receiving apparatus as parts of the same system, not as two entirely separate elements, and the entire system developed as a whole. The same course could be followed to advantage in space radio broadcasting. In the latter the vast number of receiving sets of different types and characteristics that are in use impose a limit upon what changes may be made. With the present receivers it appears that with certain changes in existing transmitters the frequency separation between stations geographically close to each other may be considerably lessened from what it now is. For example, if the frequency system of Figs. 2c and d were put in operation in the New York area similar changes could be made with stations on the Pacific Coast which occupy approximately the same frequency range. By systematically developing such a system and introducing such changes throughout the country, a relatively large number of frequency bands could be freed and room thereby made for additional broadcasting stations.

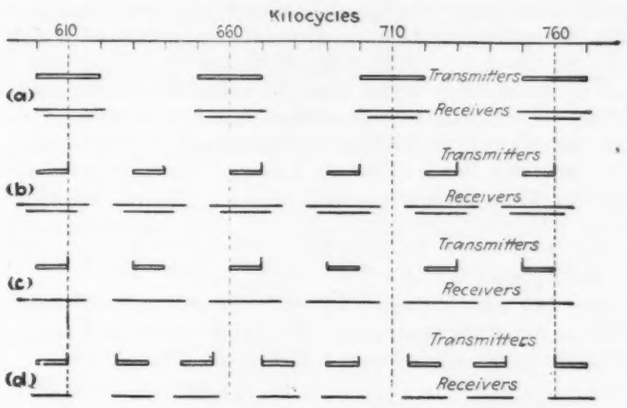



FIG. 2—SIDE-BAND WAVE SUPPRESSION WOULD DOUBLE AVAILABLE RADIO TRANSMITTING WAVE LENGTHS

The next logical step is an improvement in the receiver with a view to sharpening the frequency cut-off and flattening the response in the band pass range. Such changes will permit an additional closing of the frequency gap between transmitters. By the use of filter circuits of comparatively simple and inexpensive types, a receiver response varying less than 4 per cent over a band of 12 kilocycles and having a 90 per cent amplitude cut-off for a 0.65 per cent change in frequency in the neighborhood of 610 kilocycles has been developed for this purpose.

The present article is preliminary in character. At its writing, the first results of tests on apparatus indicate that a frequency separation of 15 kilocycles between carriers in the neighborhood of 660 kilocycles is possible with transmitters and receivers designed and constructed in accordance with the principles herein outlined, and at the most a separation of 30 kilocycles with the receiving sets at present in use. With comparatively slight improvements in the receivers a 25- or even a 20-kilocycle difference between transmitter carriers should be possible. It is hoped to discuss the system more in detail at some future date. The preliminary test results obtained, however, held such promise that in view of the present conditions in radio broadcasting it was considered advisable to make them public.

# Motor Starting Current vs. Lighting Flicker

By H. L. Wallau
*Electrical Engineer Cleveland Electric Illuminating Co.*

With the increased use of combined light and power underground low-voltage networks, the question of the maximum draught of current which may be allowed to be suddenly imposed upon any portion of such a system is being given greater consideration. The value of this current draught is dependent upon the constants of the transformers and mains installed, the location of the equipment producing it with reference to the supply points, the power factor of the load so drawn, and, finally, the maximum voltage drop, due to such load, which will not result in objectionable flicker of the lights.

In determining limits, the location at which the maximum disturbance will be caused must be chosen. For one-way feed, this will be at the extremity of the main; for two-way feed mid-way between transformers, assuming all transformers and mains to be of the same sizes and characteristics. It has been experimentally determined that a 2-volt flicker is the maximum allowable in the lighting voltage.

Assume a three-phase, four-wire secondary. Consider first a one-way feed. Let the transformer and mains have constants as follows, expressed in ohms:

| | Resistance | Reactance |
|---|---|---|
| Transformer | Rt | Xt |
| Phase Wire | Rp | Xp |
| Neutral Wire | Rn | Xn |

For a single-phase motor operating between phase and neutral, let the sum of the resistance and reactance to the end of the main be expressed as $R = Rt + Rp + Rn$ and $X = Xt + Xp + Xn$ ohms. The power factor of the starting current of induction motors will vary somewhat, but 15 per cent is a fair average value. The regulation in volts may be approximately expressed by the formula:

Volts Reg. $= IR \cos \phi + IX \sin \phi + \frac{(IX \cos \phi - IR \sin \phi)^2}{200}$, in which cos $\phi$. is the power factor at starting. This voltage drop is to be limited to two volts. The value of $I$ determined from the above formula corresponds to the locked rotor value of the motor current.

For single-phase motors operated across two-phase wires, $R$ and $X$ should be expressed as $2Rt \div 2Rp$ and $2Xt \div 2Xp$ respectively and the voltage drop allowable taken as $2\sqrt{3}$ volts.

For three-phase motors, $R$ and $X$ should be taken as $Rt \div Rp$ and $Xt \div Xp$ respectively, and the voltage drop as two volts. In most cases, at these low values of power factor, the right hand term of the equation becomes very small and the following expression may be used as a first approximation:

Volts Reg. $= IR \cos \phi + IX \sin \phi$. For loads of unity power factor, the formula simplifies to

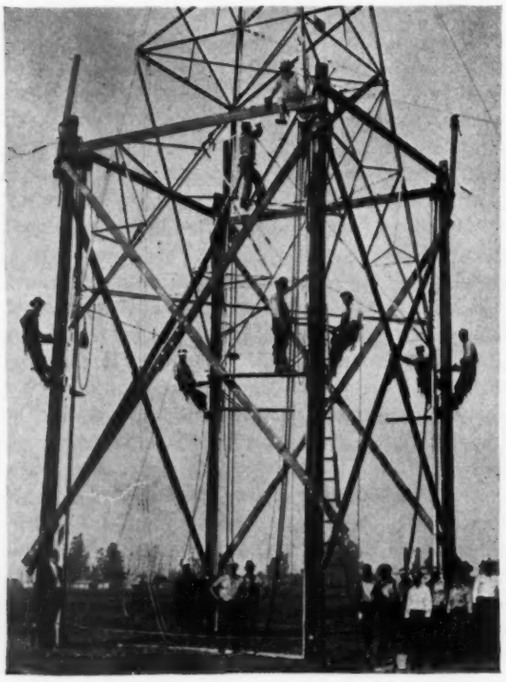
Volt Reg. $= IR + \frac{(IX)^2}{200}$, but the last term may not be neglected.

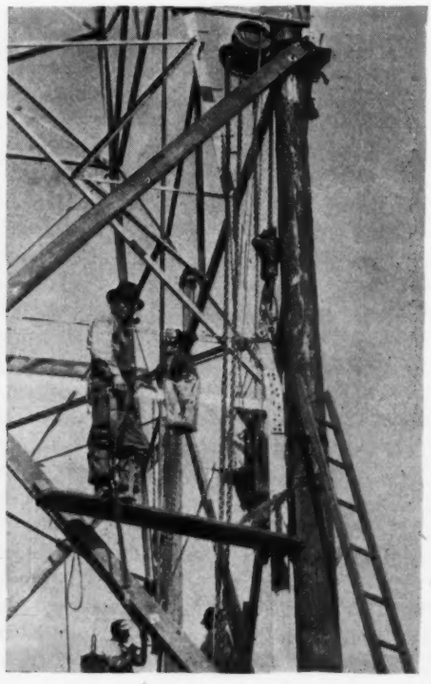
For two-way feed, the limiting values of current as determined above should be doubled since each transformer will feed one-half of the load to a motor located mid-way between the two.

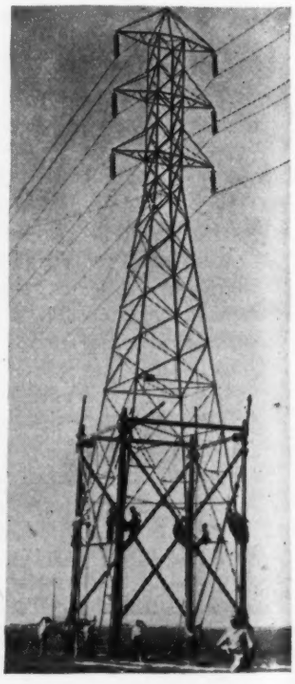
From the values of current so obtained, the allowable ratings of motors of different types may be determined.

## Transmission Tower Raised in 30 Minutes

Very often it is necessary to increase the height of transmission line towers on account of road or property improvements. In such cases the Los Angeles Gas & Electric Corporation raises the tower bodily with the line hot in the manner indicated in the accompanying illustrations. Four guyed gin poles are set at the four corners of the tower and five-ton chain blocks are used to lift the tower to the desired height, after which the steel tower extension is erected. In this manner an 80- to 100-ft. steel tower carrying a 130,000-volt line can be raised 20 ft. in 30 minutes.







# Comparison of Range Elements*

Efficiency and performance of open and closed units determined by experiments with several types and under various conditions of service

By G. J. MICKLER

*Sales Department Hydro-Electric Power Commission of Ontario*

AN INCREASING desire for accurate information as to the relative merits of the more important elements with which ranges are equipped today led to the decision to select an element of each type, of the capacity generally regarded as the principal element on a range, to subject each to a heat run test and with the aid of electrical and thermal instruments to record the performance of each and picture the comparative records by graphic illustrations. The purpose of the tests was to illustrate the comparative efficiency and performance of open and closed elements and to give to those engaged in the sale and demonstration of electric ranges some material that would enable them to convince prospective customers of the ability of electric range elements to perform efficiently and economically the service for which they were intended.

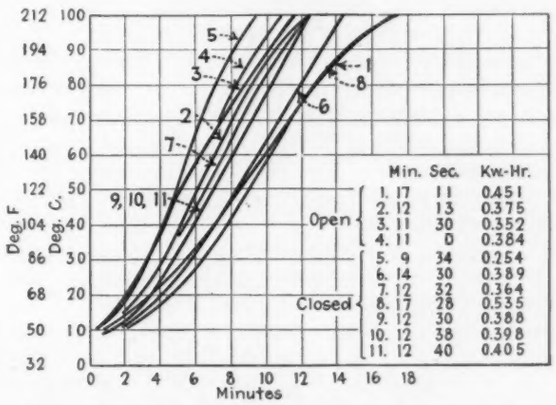
## TESTING EQUIPMENT AND PROCEDURE

The set-up for the test consisted of a standard voltmeter, a standard ammeter, a resistance for voltage regulation, a standard Centigrade thermometer with an adjustable stand to permit the thermometer being raised or lowered at will, a hot plate frame equipped with a three-heat switch, an 8½-in. copper tea kettle and a standard Imperial quart measure as well as a 110-220-volt circuit regulated to maintain 115 volts with the element switch on high.

Tests were conducted on four so-called open elements, consisting of Nichrome coils laced through porcelain grooved blocks, each being of a distinct type—distinct because each manufacturer, in order to circumvent the patents of the others, is generally forced to adopt a design of his own. Investigations were also made of seven so-called protected elements—that is, the elements or heating coils which are protected either by a covering or tubing, or by a metal plate to relieve them of outside abuse. All of these elements were the products of reliable Canadian electric range manufacturers.

In this investigation one element was tested at a time using the following procedure: An Imperial quart of tap water was placed in the 8½-in. copper kettle, temperature of the water being usually 9 deg. C., and with the element cold—that is, at room temperature—the current switch was turned to high heat, the voltage adjusted to 115 volts, and the thermometer lowered to within about ¼ in. of the bottom of the kettle. Readings were taken of the temperature of the water at 1-min. intervals until the boiling point was reached.

When the water had been brought to a boil, the current was turned off and the element allowed to cool, usually over noon hour or over night, after which two quarts of water was placed in the kettle at 9 deg. C., and the operation was repeated, taking readings of the thermometer at 1-min. intervals until the boiling point was reached. In a similar manner, after the element was cooled again, three quarts of water was placed in the kettle at 9 deg. C., the current turned on and readings taken every minute up to the boiling point.




TIME REQUIRED TO BOIL ONE QUART OF WATER FROM COLD START

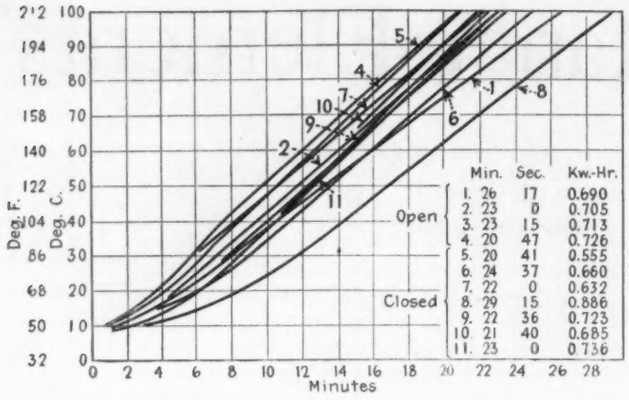
The performance of each of the eleven elements is indicated. The graph shows that closed element No. 5 boiled one quart of water in 9 min. 34 sec., with a consumption of 0.254 kw.-hr. Three open elements required 11 min., 11 min. 30 sec. and 12 min. 13 sec. respectively. The performance of open element No. 2 and closed elements Nos. 7, 9, 10 and 11 was practically the same. Element No. 4 consumed 0.384 kw.-hr., considerably more than that of some of the other elements. This one was very much overrated, offering a probable reason as to why it performed a little better than some of the others.

After this third test the element was considered a hot element—that is, about as hot as it would become in ordinary domestic service, provided it is not left on high heat without a utensil on top of it. Another series of tests was then carried on with this hot element, putting one quart of water at 9 deg. C. into the kettle, which had been previously cooled off. With the current in the element at high, temperature readings were taken of this quart until the boiling point was reached. In a

KILOWATT-HOUR CONSUMPTION OF ELEMENTS USED IN THE EXPERIMENTS

| Type of Element | No. | Kw.-Hr. | Type of Element | No. | Kw.-Hr. |
|---|---|---|---|---|---|
| Closed | 5 | 2.284 | Open | 4 | 2.742 |
| Closed | 7 | 2.472 | Open | 3 | 2.756 |
| Closed | 10 | 2.491 | Open | 2 | 2.795 |
| Closed | 6 | 2.495 | Open | 1 | 2.858 |
| Closed | 9 | 2.647 | Closed | 8 | 3.560 |
| Closed | 11 | 2.706 | | | |

*Excerpts from an address before Association of Municipal Electrical Utilities at Niagara Falls, Ont.




TIME REQUIRED TO BOIL THREE QUARTS OF WATER FROM COLD START

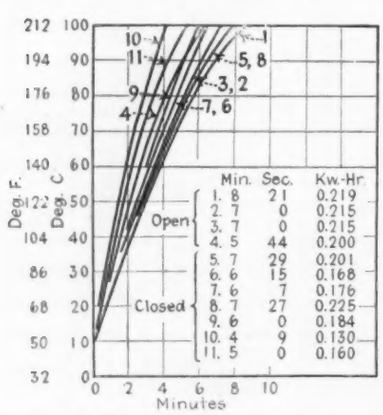
**Element No. 5 arrived at the boiling point first. This graph gives another comparison between No. 2 and No. 7, the latter being one full minute ahead of No. 2, or roughly 5 per cent faster.**

similar way two quarts of cold water and three quarts of cold water were brought to the boil on the hot element.

Upon the completion of this test, in order to find out the amount of residual heat in the elements after the current is turned off, three quarts of cold water was placed in the kettle, which was then placed on the hot element and the current turned off, and temperature readings taken every minute up to the point where there was no further rise in the temperature of the water. In the preceding tests the lid of the kettle was open to permit reading the thermometer at the lower temperature.

Another test was made to determine how long the boiling operation would continue after the current was turned off under three quarts of water which had been brought to the boil previously. In this case readings of the thermometer were taken until the temperature had dropped below 99 deg. C. In this case the lid of the kettle was closed and the thermometer inserted through an opening.

An additional determination was made on closed elements with a metal plate covering to show the effect of improving the contact between the surface of the element and the bottom of the kettle by pouring water on the cold element and also by pouring mercury on the cold element and comparing the results obtained when boiling one, two and three quarts of water on an initially cold element. The results were plotted, curves being drawn and calculations made to show the time required by each element to perform each function and the number of kilowatt-hours of energy expended. The graphs for the heating from a cold start indicate that some of the closed elements take a somewhat longer time to get started, whereas the open elements show a much more rapid temperature rise, since the coils are more or less free to exert their energy upon the kettle as soon as the current is turned on. One interesting point that it might be well to note is that No. 2 (open) and No. 7 (closed) elements, which are of practically the same rating, require the same time to reach the boiling point. These elements are manufactured by the same company and afford an interesting comparison of the speed of open and closed elements.

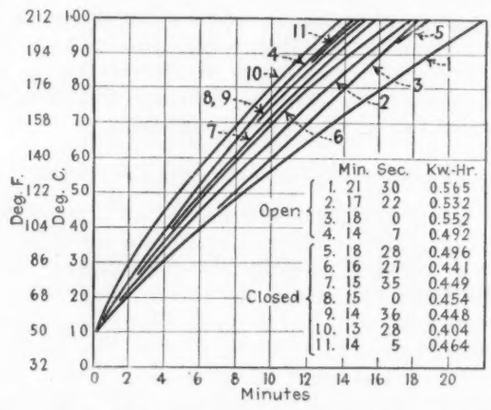



TIME REQUIRED TO BOIL ONE QUART OF WATER FROM HOT START

**In this case the three closed elements are first followed by No. 4, the high-capacity element. It will be seen that No. 5, which was in front in the cold tests, is now pretty well to the back.**

It might be well to explain that the reason No. 8 element shows such a poor performance is that with a kettle the bottom of which is perfectly flat and with an element that is not perfectly flat, the contact between the two not covering a very large area, the radiation from the element to the kettle and into the water constitutes a very slow process. Apparently the air space between the element and the kettle, and the possibility of circulation of air carrying off the heat, slowed up the operation very materially.

When plotting these curves it was found that elements with a cast-iron cover absorb a little more heat and give it off a little more readily than do open porcelain elements. On the graph for the temperature rise of three quarts of water on a hot element the temperature rise of one of the cast-iron elements is shown as 63 deg. C., or about 140 deg. F. The other cast-iron elements are somewhat lower and not very far away from a porcelain element, which brought water up to 122 deg. F. This may answer some of the arguments about the absorptive power of porcelain as compared with cast iron. The general opinion is that porcelain does not absorb heat and all the heat generated by the heating coils passes through the air into the kettle and into the water, whereas cast-iron elements take up and hold a lot of the heat given off by the heating coils. It is true they absorb a lot of heat, but they give it off very rapidly, once they get hot. Porcelain is slow to absorb the heat, and it is just as slow to give it off, although these curves show that the amount of heat absorbed by the porcelain may be almost as much as that absorbed by the cast iron in some cases. This depends, of course, on the amount of porcelain and the amount of insulation beneath it.

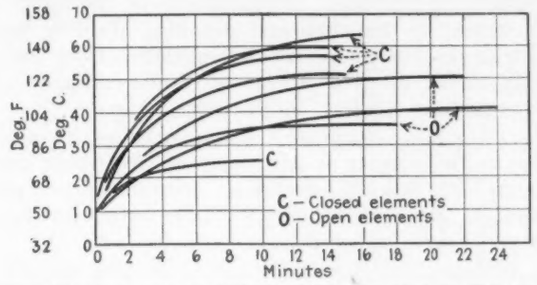



TIME REQUIRED TO BOIL THREE QUARTS OF WATER FROM HOT START

**Closed element No. 10 is in the front, followed by Nos. 4, 11, 8, 9, 7 and 6. This series of tests on hot elements shows beyond a doubt that closed elements are considerably faster than open elements, due to their giving off evenly the heat stored in the element in the first part of the operation of bringing water to a boil. This is further illustrated by a comparison of the kilowatt-hour consumption, which shows that with two exceptions the kilowatt-hour consumption by closed elements is less than that of the open elements.**

The same thing is true of the amount of heat absorbed by cast-iron plates.

The interesting feature of this subject is not that porcelain will absorb as much heat as cast iron but the demonstration of the value of the heat that is stored in an element and that in many cases is lost if economical




TEMPERATURE RISE OF THREE QUARTS OF COLD WATER ON HOT ELEMENTS

The extent to which different types of elements store up heat when the current is turned on was indicated by placing three quarts of water over a hot one, turning the current off and observing the temperature rise of the water until a maximum was reached.

operation of a range is not carefully studied. If it is desired to utilize all the heat that is given off by a range element, either open or closed, after certain boiling operations have been completed, and there are many times when it is just desired to bring water to a boil, the residual heat in an element should be made use of. That is to say, supposing the kettle to have been brought to the boil for making tea. When sufficient water has been drawn off the kettle for the tea, it should be filled up with cold water, and this kettle full of water placed on the hot element. These curves show that in about the time that it takes to eat a meal there will be enough hot water to wash the dishes in the average home. If you put warm water in the kettle of course the temperature would be much higher at the finish than it is when you put cold water on, but with cold water at the start, the temperature rise to from 122 to 150 deg. F. is as much as any one requires for dish-washing purposes.

The table on page 199 gives the consumption of each of the individual elements used in the foregoing experiments. These figures give a fair comparison between the elements, as the duties performed can be considered diversified.

## New Voltage Standardization Booklet

BASED on a recent survey of electric voltages, a booklet has just been published by the voltage standardization sub-committee of the lamp committee of the National Electric Light Association, showing the lighting voltages in nearly 19,000 communities in this country. This is the first reissue of a similar booklet published in 1923; comparison with the latter shows considerable progress in voltage standardization toward the objective recommended by the lamp committee in 1923—that "the recommended standard practice be the selection of such a service lamp voltage as will supply the proper average voltage to 115-volt lamps," with 110-volt systems and existing 120-volt systems as recognized departures.

In the five years between the publications of 1923 and 1928, the number of communities having 115-volt service only advanced from 35.6 to 68.2 per cent of the total, while the 120-volt communities have increased only from 8.2 to 11.1 per cent and those served at 110 volts have decreased from 47.7 to 19.9 per cent. The total served at one of the standard voltages has increased from 91.5 to 99.2 per cent in number, or from 95.2 to 99.7 per cent when those using more than one voltage, but all standard, are included. Also, there has been a gain of 8 per cent in the total number and 11 per cent in the total population of the communities having only one single-standard lighting voltage reported for the entire city.

In the new publication, the old data were completely ignored and a fresh start was made; 3,517 towns of the earlier list, regarding which no information was received, were dropped, but 7,746 new ones were added. As the total population of the towns listed in both issues is approximately the same, it is evident that the new towns are relatively small.

Returns show frequent cases of small plants, and particularly municipal plants, having been sold or changing their source of supply to purchased energy, and indicate a general tendency toward the supply from larger, and therefore more economical, generating stations.

In the listing, the number of towns served by municipal plants has decreased from 1,732 to 1,200 and the populations so served from 4,347,500 to 3,351,300. There has thus been no notable change in the average size of towns served by municipal plants. It is noted that these plants are lagging in the nation-wide movement from 110 volts toward the central standard of 115 volts.

## Ground Return for Series Street Lighting

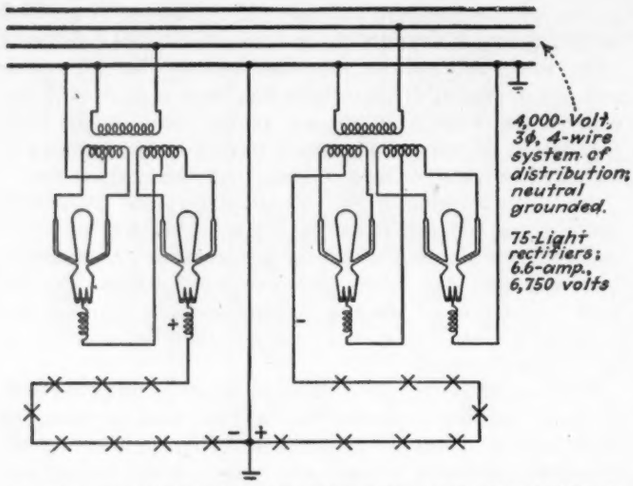
By J. A. Cook

*Superintendent Electrical Department Lynn (Mass.) Gas & Electric Company*

GROUND return for series street-lighting circuits is being successfully used by the Lynn Company in its recent extension of "White Way" lighting. One conductor per circuit is saved in the underground cable system. Two-wire service is continued in overhead territory, because the investment saving there would be very small and tree conditions make overhead wire return desirable.

The lighting units on the extension involve 2,500, 10,000 and 15,000-lumen incandescent lamps supplied by 20-kw., type "R.O." General Electric constant-current transformers mounted on poles on side streets adjacent to the underground district. A cable fault can readily be located, since the lamp immediately beyond the fault will be dim or out, and the lamp just before the fault will burn at full brilliancy. Each of the transformers has a control switch with operating solenoid connected in one of the existing street-lighting circuits leading to the station. A maximum of two transformers is connected per station circuit. When the operator energizes the outgoing street-lighting circuits the transformers are switched upon the commercial light and power 2,300-volt circuits at various points. This increment of street lighting service is, accordingly, obtained at low investment cost and entails the maintenance of only a short additional length of underground cable.

A more important use of the ground return is for the ornamental luminous arc lamps on main business thoroughfares. Ground return reduces the investment for these units, which is otherwise particularly heavy, since the arc lamps require uni-directional current of high voltage supplied by constant-current mercury-arc rec-




THREE-WIRE CONNECTION AND GROUND RETURN FROM ADJACENT SERIES CIRCUIT TERMINALS

tifiers installed in an attended station and frequently there is a long distance between the last lamp on the circuit and the station. The Lynn company uses 75-light General Electric rectifiers, each of which serves its load over a single No. 6 A.W.G. cable. At the last lamp on the circuit a solid connection is made to the cable sheath and also to a nearby water pipe. One side of the rectifier unit is similarly connected to ground. This system has been in satisfactory operation for about two years. Six units are in service with ground return.

Measurement of resistance of ground return on a typical Lynn circuit by voltmeter method shows the ground resistance to be only 0.71 ohm. The airline distance from the grounding point to the station is 6,000 ft. This length of No. 6 A.W.G. copper wire has a resistance of 2.4 ohms.

When these rectifier sets were first put in service, a certain amount of operating trouble was experienced on account of the higher voltage to ground sustained by the first ten lamps in each circuit nearest the station. In the usual wire-return circuit the point of ground potential is approximately midway in the circuits of lamps, and, accordingly, the maximum voltage-stress to ground corresponds to half the total circuit voltage. Circuits operated with ground return have low voltage to ground on lamps near the grounded terminal and full voltage on the other end.

Initial operation of these circuits demonstrated that the lamps, insulators and cutouts manufactured for two-wire circuits would not give satisfactory service on ground return circuits under Lynn conditions. In those cases known to the author, where ground return is used by other companies, street lighting standards had wooden shafts supporting the lamps. Such shafts contribute materially to the circuit insulation. The Lynn system uses King all-metal standards, which are solidly grounded to the cable sheathes and the water-pipe system, so that the full voltage to ground is impressed across the lamp insulator at the top of the standard. The General Electric Company increased the thickness of the lamp insulator by nearly one inch and provided absolute cutouts with a larger amount of surface insulation than was previously standard. The operating results compare favorably with those obtained by two-wire return.

The telephone company's representatives investigated to determine whether or not return of street light current through the ground produced objectionable inductive effects in telephone circuits. They found no disturbance and gave the installation their approval.

It is interesting to note that, where two circuits can be made to terminate adjacent to each other, the ground connection can be made on the negative side of one circuit and on the positive side of the other. Accordingly, the ground current is confined to the short distance separating the grounded lamps of the two circuits. The Lynn company did not install the system in this way, but it seems to be possible of successful application where soil has high resistance or where inductive effects may be detrimental.

## Brazilian Generating Station Inspires Rudyard Kipling

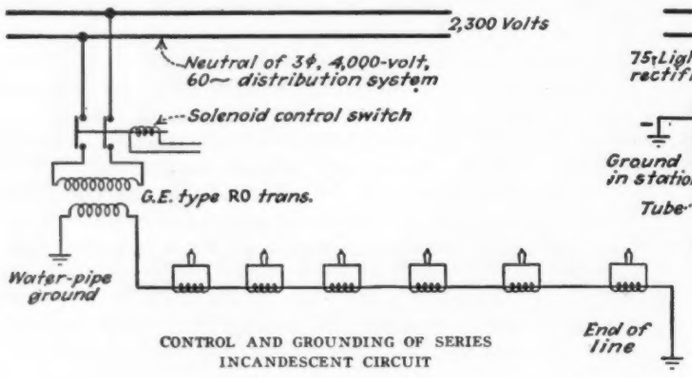
RUDYARD KIPLING visited an electric power house near Santos, Brazil, on a recent trip to South America, where he inspected a generator which, according to the eminent English poet and story writer, "spins upon the largest bearings in the world." It served as an inspiration for a two-stanza poem which is published for the first time in America in the current issue of the weekly magazine *Liberty* and is as follows:

SONG OF THE DYNAMO

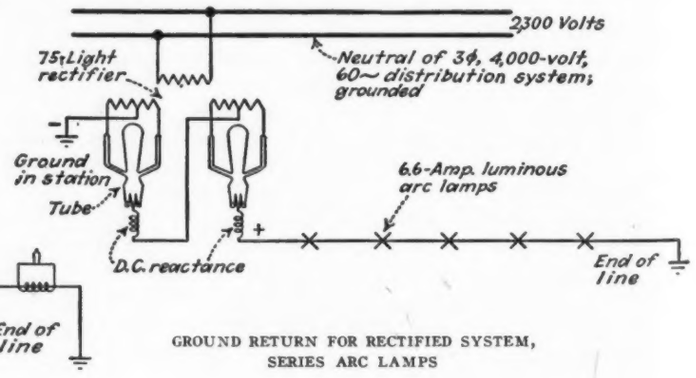
How do I know what Order brings
  Me into being?
I only know, if you do certain things,
  I must become your Hearing and your Seeing;
Also your Strength, to make great wheels go round,
And save your sons from toil, while I am bound!

What do I care how you dispose
  The Powers that move me?
I only know that I am one with those
  True Powers which rend the firmament above me,
And, harrying earth, would save me at the last—
But that your coward foresight holds me fast!

(Copyright, 1927, by Rudyard Kipling in the U. S. A.)




CONTROL AND GROUNDING OF SERIES INCANDESCENT CIRCUIT




GROUND RETURN FOR RECTIFIED SYSTEM, SERIES ARC LAMPS

## Factors Affecting Accumulation of

# Depreciation Reserve

Life dependent upon definition of unit. Accounting for removal costs. Annuities for special short life installations. Interdependence of plant items with respect to life

By W. G. Cross

*Assistant Valuation Engineer Southern California Edison Company, Los Angeles, Cal.*

IMPORTANCE of the definition to be used when considering depreciation or any of its phases has been stressed previously in this series of articles. As has been noted, depreciation may relate to price, thus producing lessened market value; to serviceability, thus assuming a less efficient article of use; to physical structure, with a resultant weakened structure from the service angle or a structure containing less physical material and thus a lessened wearing life; and in a very great variance of ways to functional use, indicating decreased present value or lessened future life.

Not all replacement, repair, etc., caused by a wearing-out process may normally be considered depreciation from an accounting point of view, or even from the point of view of an engineer. The replacement of bearings in rotating apparatus is almost universally considered an operating expense or, at least, a type of expense which is not the fundamental wearing out of the item. Reference has already been made to the question of definition of the smallest unit to be used in accounting for depreciation, pointing out that a complete unit, ordinarily renewed by repairs, etc., may have a life much in excess of the individual parts which comprise such a unit. If the individual parts themselves were considered the unit, the life, or service value, would almost universally be less than that of the more inclusive unit and would require entirely different treatment.

Moreover, the practice of a utility or the regulating commission supervising the utility, may decide that, for accounting purposes, certain costs shall be considered operating expenses rather than expenses to be taken care of through a depreciation reserve. While it is customary to charge the costs incidental to the retirement of most items against the depreciation reserve, in the state of California it is specifically provided that the removal of meters and services, during the life of the item, shall be considered operating expense.

While it is fully realized that there are many utilities which may not desire to take care of replacements through a depreciation reserve, all such expenditures being handled as operating expenses, the discussion in these articles is based upon the premise that the cost of retiring plant at the end of its life may cause such a disturbance, if considered a portion of the operating expenses, as seriously to change the uniform character of such expenses. Thus it is rendered very difficult to forecast yearly operations and to set rates and collect revenues in such a manner as to provide for these fluctuating expenses. With such a thought in mind, a great many utilities accumulate a fund by means of annuities in such an amount that this fund, theoretically, will always have available sufficient money to reimburse the utility for the cost of the item at the date when it ceases to function usefully. As has been noted, the minimum item, or the unit, must be positively defined, for it is not logical to provide a fund to retire a boiler at the time when that boiler shall be considered to have completely ended its life, and then inconsistently withdraw funds from the reserve, at a period much earlier than the complete retirement, to take care of the retirement of the fire-brick linings or boiler tubes comprising a portion of such boiler.

Two factors pertaining to depreciation and the accumulation of a reserve have not, so far, been noted. They are the salvage value to be obtained from a unit at its expiration of life and the cost of physically removing or retiring the item. The reserve is usually designed to take care of both, that is, to reimburse the original "wearing value" or cost of the item, less its salvage, and to provide a sum of money sufficient to pay the cost of removal.

### Salvage Value and Removal Cost

In determining the wearing value, attention must be given to salvage value at the end of life. Three methods are in common use: one assumes that the salvage will practically be offset by the removal cost; another, that the estimated life may be arbitrarily lengthened, when computing the annuity, to make allowance for net salvage; third, an attempt may be made to compute the wearing value by estimating the probable salvage. The first method is not ordinarily considered a distinct method, but is rather assumed when a utility makes no allowance for salvage or removal cost in its depreciation calculations. It is very commonly used, however. The lengthening of lives for salvage is feasible, but is a somewhat indirect method. In general, comparatively little lengthening is required to take care of net salvage obtained, if handled on a net salvage basis. The third method, which makes an attempt to compute salvage, cannot, at best, be more than a vague estimate which is subject to conditions of price, future state of the art, business conditions, new inventions and almost every other conceivable contingency. It is doubtful if such a method produces results any more accurate than either of the previous types of estimates.

With respect to the depreciation reserve taking care of removal costs, the situation becomes somewhat complicated when removals take place prior to the expiration of the ordinary life of the material in question. The reserve, as accumulated, ordinarily is designed for the purpose of taking care of one removal. If a substation transformer, for instance, is moved between substations three or four times during its life, the reserve is, in theory, not adequate to take care of the expense thus involved, and such costs would properly go against operating expenses. In theory, this is true but, in practice, it is often difficult, from an accounting point of view, to distinguish an "interim" removal from a final removal. Such determinations might be made in the case of a small utility, but in a larger utility where thousands of items are involved, such a course is not always practicable. It is, therefore, often the case that the reserve is called upon to take care of these interim replacements. Under such conditions, the one handling the depreciation accounting must carefully consider the effect of such additional expenditures, and, possibly, make provision in the annuity. It will be noted that the cost of interim removal, which is mainly a labor cost, is similar in its aspects to partial replacement of a unit such as a boiler, but the reason why interim replacements are charged against the reserve is merely to facilitate accounting. The procedure is not entirely logical.

### Short Life Installations

A problem is presented in the case of engineering design, where, in order to give proper service, units must be installed under such conditions that the life will be greatly foreshortened. If it is known, for instance, that a certain pole line, or set of pole lines, is installed for the purpose of serving an industry which will be in existence only for five years, and that the location, perhaps, is such that very little salvage can be expected at the end of that period, special note must be taken of such considerations. It is, ordinarily, not practicable to set up a special reserve for individual pieces of property of this nature, as the accounting would become so complicated that it would be too cumbersome and expensive. If, on the other hand, average lives (including all the property of the company) are shortened, or other constants modified below those customarily used in utility work, regulatory bodies and such of the public as are interested in public utility matters are likely to look with suspicion upon such procedure, and refuse recognition of any adjustment which tends to increase the depreciation annuity, and thus increase rates which are based upon the cost of service.

Such conditions, however, are sometimes precedent to good service, and it is very interesting to note that the California Commission, in a decision dated Dec. 31, 1926,* noted that the company's engineers had used somewhat shorter lives than those previously accepted, in claiming an annual allowance for depreciation, and apparently looks with approval upon the change, stating that "rapid growth of the company's load is calling for the replacement of many pieces of equipment on account of lack of capacity before they are worn out in service. To quite an extent, it is more economical to install moderate-sized equipment and replace it before it is entirely worn out than to carry the extra investment in the larger equipment to avoid such replacement." If lives are not shortened, replacement should be charged to operating expenses, or some other provision should be made.

An error frequently made is that of neglecting the life relationship which obtains between various items of equipment in a plant. A concrete dam may perhaps be considered as of almost indefinite life, but if the hydroelectric project of which it forms a part is subject to a limited tenure of life, say, 40 years, not only should the annuity to retire the structure be accumulated on the short-time basis, but, presumably, some other large accumulation may have to be made to take care of the heavy costs of physical removal of this type of structure.

Again, a concrete power plant building is ordinarily thought of as having a long life, perhaps 40 years. In the case of modern steam plants, however, such a building is little more than a set of massive foundations for the generating equipment, with walls to keep out the wind and a roof to shed rain. The steam turbine equipment resting upon the foundations which form a large part of the building may be retired at the end of twelve years. It would be unreasonable to suppose that these same foundations would be satisfactory for such new type of equipment as might later be installed. The building's usefulness ceases at the time of retirement of the equipment. The author knows of no instance where generating plant buildings, either hydraulic or steam, have ever been used for a subsequent installation of hydro or steam generating equipment after the original installation has lived its life and been retired, and it is extremely improbable that such subsequent use could be made, except at the expense of engineering efficiency. As in the case of dams, the cost of removing these foundations may be very great. Obviously, therefore, the building life is not 40 years.

### Prolonged Life By Maintenance

The prolongation of life by maintenance is a subject requiring careful attention in discussions of depreciation and determinations of estimated lives. It is quite evident that not only can an item be used beyond the time when it would ordinarily be replaced by the process of making extraordinary repairs but it is further true that many utilities are forced, by financial circumstances, to do this very thing. Under such conditions, the question arises as to whether the additional amounts thus accumulated in the reserve should be utilized for making repairs. In general this procedure may be said to be defensible only when the condition is clearly apparent.

In the case of determination of accrued depreciation, it is commonly accepted that a certain amount of "normal maintenance" may exist without being considered as existing depreciation. Such maintenance, accumulating between visits of the repair gang, is that maintenance usually taken care of through operating expenses. In the case of "deferred maintenance," however, the question is more difficult. If normal operating expenses have not been expended and the property is in a state of repair lower than that which would normally be considered reasonable by a financially solvent operating company, it is quite evident that an estimate will have to be made for such a condition in adition to the other factors commonly entering in.

Another feature of interest is one that is never shown in actual calculations when determining accrued depreciation, but is none the less there and should have a certain amount of weight. In the case of generating plants,

**California Railroad Commission, re Los Angeles Gas & Electric Corporation, P.U.R., 1927, C-568.*

substations and other sections of plant where co-ordinated mechanical operation is required, it is distinctly true that the first few months, and sometimes years, of operation require a greater expenditure than the succeeding years, due to the fact that difficulties have to be met and overcome and the plant has to be "broken in." In many cases a plant is in better operating condition at the expiration of the first or second year than it was at the beginning of its service. It is very difficult to make an allowance for such a condition of appreciation mathematically, and, hence, it is seldom ever done. Depreciation by inspection is able to make some allowance for this condition by offsetting the appreciation against factors of wear and tear, but it is probable that the only way mental processes ever take care of this factor is by the indirect route of assigning a "going value" to a plant in complete operation. This seems to be a crude attempt to allow for the fundamental feature, but no better way appears to be offered.

The absence of definite terms of measurement for depreciation and remaining value often renders it difficult to determine the amount expressed in dollars which may exist in a property, but, if the fundamental conditions are consistently kept in mind throughout any set of estimates or calculations, a result can always be obtained based upon the particular premises involved, and it is only fair to qualify the answer with the statement that it is based upon those certain premises. Similarly, in matters connected with determination of depreciation annuities, there is but one fundamental end to be attained, and that is that the utility should be recompensed for its entire investment during the period of service in such a way that the company will remain whole when the article has ceased to function usefully.

# Reducing Distribution Losses

SIXTH ARTICLE

## *Loss-Testing Equipment*

By J. B. Moorhouse

*Electric Distribution Engineer Central Illinois Public Service Company, Springfield, Ill.*

THE FIELD WORK involved in the reduction of transmission and distribution losses falls upon the shoulders of the division distribution man designated in the organization chart accompanying the first of these articles. In order that he may be prepared to make investigations completely, he must carry a number of electrical testing instruments, both indicating and graphic.

| Quantity | Article | Scale |
|---|---|---|
| 1 | Indicating ammeter | 0-5 |
| 1 | Indicating voltmeter | 0-150-300 |
| 6 | Graphic ammeters | 9-5 |
| 6 | Variable ratio current transformers | 25/50/100/200 |
| 8 | Graphic voltmeters | 90-130/180-260 |
| 2 | Potential transformers | 20:1 |
| 1 | Potential transformer | 60:1 |
| 1 | Line test set (Indicating ammeter and split core current transformer) | 0-35-125-250 |
| 2 | Ground current detectors | |
| 1 | Ground rod resistance test set | 0-40 ohms |
| 1 | Panel body truck ½ ton capacity. Miscellaneous cable, rubber protection, tools, hand lines, etc. | |

A large number of instruments would require a heavy truck for transportation. This would be too slow and expensive. The few instruments which could be carried in a small car would be inadequate. To cover the situation, a ½-ton panel body truck has been used with the equipment listed in the accompanying table.

The distribution man in each operating division spends his entire time investigating losses. He is assisted by a man who takes notes used for the preparation and revision of distribution maps. The division meter man is also available when needed in checking questionable meter operation.

# Material-Handling Crane Saves Time and Labor

A 5-TON monorail electric crane installed at the distribution headquarters of the Los Angeles Gas & Electric Corporation has been found a great aid in loading and unloading distribution transformers and handling other heavy material used in overhead and underground construction work. As may be seen from the accompanying illustration, the crane has floor control for the motor for raising and lowering and chain control on the travel of the carriage. Transformers are placed on special loading skids so that the hand lift truck shown may be run under the skid and used for raising and moving the transformer about. The crane is also very useful for loading and unloading cable reels carried by trailers.

ELECTRIC CRANE LIFTING A 100-KVA. SUBWAY TRANSFORMER FOR LOADING ON TRUCK

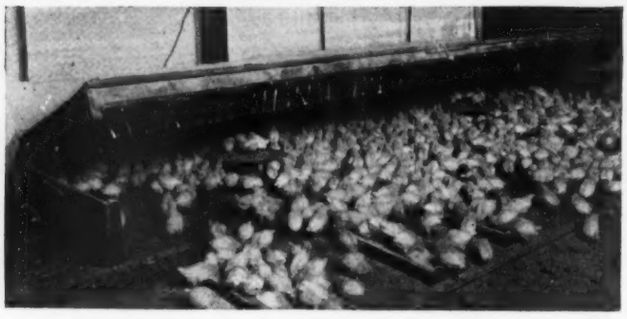
# Electric Brooders Bring Good Revenue

## Survey shows cost of 2 cents per chick. One kilowatt-hour per chick required. Large load developed in western Washington

By J. C. Scott

*Agricultural Service Puget Sound Power & Light Company, Seattle, Wash.*

DURING the 1927 brooding season, from January to June, fully 1,500,000 chicks, or approximately 25 per cent of the chicks raised in western Washington, were brooded electrically. Complete data compiled by the Puget Sound Power & Light Company during the



ELECTRIC UNDER-HEAT BROODER OF 1,000 CHICK CAPACITY OPENED TO SHOW INTERIOR

past brooding season on a number of electric brooders reveal some valuable information.

It was found that the average cost of electric current in the Puyallup district to bring one chick through the six-weeks brooding season was 2.1 cents. To obtain this figure 68 poultrymen, using 121 brooders of all makes, and 69,500 chicks were considered. A total of 70,675 kw.-hr. was required to brood the 69,500 chicks, or approximately 1 kw.-hr. per chick. The rate for the brooders was 4½ cents for the first 100 hours' use of the demand, and excess at 1 cent. A summary of results of the survey are given in the accompanying table.

A check of electric brooding costs in the Bellingham and Lynden (Wash.) districts showed the average cost for current to brood one chick for the entire brooding season to be 1.94 cents. This was based on 24 poultry farms and 45,400 chicks. In this instance, as in the Puyallup districts, the cost ranged from less than 1 cent to more than 3 cents to brood one chick. It required 40,173 kw.-hr. to brood 45,400 chicks, or 0.884 kw.-hr. per chick. The rate in this case also was 4½ cents for the first 100 hours' use of the demand and excess at 1 cent.

Poultrymen in western Washington have found that brooding with modern electric brooders produces better chicks and a more uniformly developed flock, reduces labor, care and attention, reduces fire hazard almost to nil and in most cases costs less than with fuel. Through its agricultural service division the Puget Sound Power & Light Company is actively developing the electric brooder load and expects 50 per cent of the 6,000,000 chicks raised in its territory during the spring of 1928 to be brooded electrically.

DATA ON ELECTRIC BROODING OF CHICKENS BASED ON 121 BROODERS AND 69,500 CHICKS

| | Max. | Min. | Average |
|---|---|---|---|
| Number of chicks per customer | 3,000 | 500 | 1,000 |
| Wattage of individual brooders | 1,200 | 500 | 750 |
| Kw.-hr. used during brooding season | 3,293 | 247 | 1,023 |
| Demand (kw.) per customer | 2.7 | 750 | 1.16 |
| Average rate paid per kw.-hr. (cents) | 3.5 | 1.45 | 2.1 |
| Customer's bill for brooding season | $62.23 | 8.89 | 21.60 |
| Number days brooding per batch of chicks | 60 | 30 | 45 |
| Kw.-hr. per chick | ..... | ..... | 1.015 |
| Cost per chick (cents) | ..... | ..... | 2.17 |

# Electrical Industrial Trucks Necessities at Grand Central Station

"WITHOUT our 50 drop-frame electrical industrial trucks," states H. A. Currie, assistant electrical engineer of the New York Central Railroad, "it would be impossible to operate the terminal and to care for even the normal amount of baggage. Hand trucks, no matter how many of them, could not possibly replace the electric baggage trucks."

Everything that is carried in a mail or baggage car is trucked from the train platforms on the electrical industrials. The mail averages 2,000 tons per day. Baggage amounted to 139,638 pieces in June of this year and 2,255 tons of newspapers were loaded. The tremendous task is accomplished quickly and well by some 50 vehicles, the majority of the drop-frame type but with five light-weight units for last-minute baggage service. The drop-frame trucks are built with platforms close to floor level, batteries being carried under one raised end and the motor under the other. Each has a capacity of 4,000 lb. The American Railway Express Company operates 42 drop-frame industrials in the same terminal.

The trucks used by the New York Central Railroad travel 115,000 miles a year, averaging 4½ miles a day apiece. A repair room is maintained in the terminal. Overhauling is done, not oftener than once in 2½ years.

ELECTRIC DROP-FRAME TRUCKS SPEED TERMINAL MAIL AND BAGGAGE HANDLING

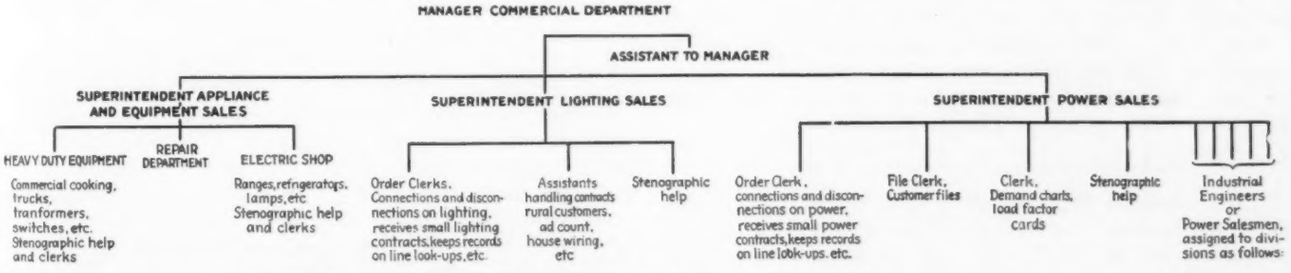
The battery room contains sufficient batteries to provide an extra set for half the fleet. These are kept constantly on charge, and as it requires but eight hours to impress a full charge the trucks are kept in 24-hour service by replacing the batteries in half of them at sixteen-hour intervals. Electricity for this service is supplied by the New York Edison Company.

# Commercial Department
# Organized for Service

**Principles and objectives of a central-station company's sales department. Formation of lighting, power and merchandise divisions that permits flexibility**

By B. J. GEORGE
*Industrial Engineer Kansas City Power & Light Company, Kansas City, Mo.*

LOAD BUILDING and new-business development have become matters of vital importance to electric light and power companies within the last few years. What scheme of organization will prove most practical in rendering advisory service to customers and in adding revenue-producing business has been much discussed among utility men, who are confronted by the fact that many existing commercial departments have expanded and grown along lines of expediency rather than upon any definite program looking to a well-balanced and efficient sales organization. Obviously no set rules can be laid down nor could one company's plan of organization be applied rigidly to some other company. Each has different requirements depending upon size, location and nature of business served. There are, however, certain principles and definite objectives in sales operations that are common to all electric utilities and that may be used as the basis for setting up a workable scheme of sales organization.


MANAGER COMMERCIAL DEPARTMENT
ASSISTANT TO MANAGER
SUPERINTENDENT APPLIANCE AND EQUIPMENT SALES
SUPERINTENDENT LIGHTING SALES
SUPERINTENDENT POWER SALES
HEAVY DUTY EQUIPMENT
REPAIR DEPARTMENT
ELECTRIC SHOP
Commercial cooking, trucks, tranformers, switches, etc. Stenographic help and clerks
Ranges, refrigerators, lamps, etc Stenographic help and clerks
Order Clerks. Connections and disconnections on lighting. receives small lighting contracts, keeps records on line look-ups, etc.
Assistants handling contracts rural customers. ad count. house wiring. etc
Stenographic help
Order Clerk. connections and disconnections on power. receives small power contracts, keeps records on line lobk-ups. etc.
File Clerk. Customer files
Clerk. Demand charts, load factor cards
Stenographic help
Industrial Engineers or Power Salesmen, assigned to divisions as follows:
Heating, cooking, refrigeration, building materials, steel and iron, milling, food products, textiles, municipal power, street lighting, wood working, mining, battery charging theaters, office buildings, railway electrification, etc.

SUGGESTED BASIS FOR ORGANIZATION OF COMMERCIAL DEPARTMENT

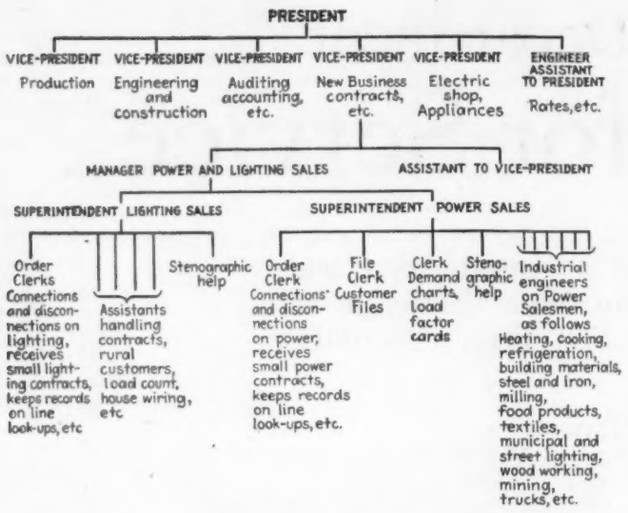
## PUBLIC RELATIONS VALUE OF DEPARTMENT

The commercial department of a public utility occupies a peculiar position in that it is the medium of contact between the utility and its source of revenue—its customers. It thus offers a point of contact with the public that is vital to the existence of the company. It must, of necessity, be correlated with the other departments of the utility—it must work hand in hand with the engineering and construction departments, since the engineering department supplies plans and estimates for line extensions pertinent to service to new or existing customers, the plans later being executed by the construction department.

Co-operation with the operating department enables the commercial department to be ready at all times to advise customers concerning the reliability, continuity and general satisfaction of the service rendered. The bookkeeping and collection departments supply the commercial department with information as to the billing and collection records pertaining to the customers' accounts. Likewise, each of the departments throughout the company supplies essential information and service to the commercial department. In fact, the department must look to every other department for its working material with which to approach the customer. This does not place the department in a minor position, but rather its co-dependence upon the other departments is a corollary to the proposition that each of the other departments depends upon the commercial department for its volume of work. Let it fail, and the work and importance of the other departments diminish. Let the sales engineers be sluggards, and new customers appear not, while old customers vanish.

A utility commercial department may be organized in a number of ways depending upon the volume and nature of the business handled. An ideal arrangement might consist of a chief-in-charge, under whom are three superintendents of lighting, power and appliance and equipment sales. Sometimes all three are grouped under one department head. In some cases one or more of the divisions may be under a chief, separate and distinct from the chief-in-charge of the remaining divisions. It must be realized that only in exceptional cases can there be an iron-clad, separate and distinct division among the functions of the subdivisions. An organization chart is good in so far as it is not permitted to bind and prohibit efficiency.

The lighting sales and power sales divisions handle all


PRESIDENT
VICE-PRESIDENT Production
VICE-PRESIDENT Engineering and construction
VICE-PRESIDENT Auditing accounting, etc.
VICE-PRESIDENT New Business contracts, etc.
VICE-PRESIDENT Electric shop, Appliances
ENGINEER ASSISTANT TO PRESIDENT Rates, etc.
MANAGER POWER AND LIGHTING SALES
ASSISTANT TO VICE-PRESIDENT
SUPERINTENDENT LIGHTING SALES
SUPERINTENDENT POWER SALES
Order Clerks Connections and disconnections on lighting, receives small lighting contracts, keeps records on line look-ups, etc
Assistants handling contracts, rural customers, load count, house wiring, etc
Stenographic help
Order Clerk Connections and disconnections on power, receives small power contracts, keeps records on line look-ups, etc.
File Clerk Customer Files
Clerk Demand charts, Load factor cards
Steno-graphic help
Industrial engineers on Power Salesmen, as follows Heating, cooking, refrigeration, building materials, steel and iron, milling, food products, textiles, municipal and street lighting, wood working, mining, trucks, etc.

TYPICAL ORGANIZATION FOR LIGHTING AND POWER SALES

negotiations and contracts pertaining to their respective classes of business. The lighting sales department handles domestic lighting and house wiring. The power sales division is usually found to be more or less indistinctly divided into subdivisions pertaining to a certain class of customers, a certan class of industries or particular classes of applications of the product of the utility. The size of the company and the extent of its operations will, of course, largely determine the subdivisions. For example, ice and refrigeration industries, cement industries, apartment hotels, office buildings and theaters and industrial heating may be found in the widely ranged subdivisions. Each subdivision is delegated to one or more industrial engineers, who are to a degree specialists in their particular line and who co-operate with their fellow workers when problems interlink.

## Qualifications of the Power Salesman

The industrial engineer thus assigned to a particular class of business is enabled through attention to the articles in the technical press and attendance at conventions to keep up to the minute in his knowledge of the particular class of business assigned to him. The qualifications of a power salesman are a technical education, practical engineering training, a viewpoint of the industry, faith in himself, his company, its products and its ideals, a good address, courtesy, honesty and integrity of character and, above all, ability to judge men. In addition to the industrial engineers, there are, of course, the clerical force, stenographers and statisticians, the latter having to do more largely with the keeping of records as to demands, consumption, cost per kilowatt-hour and cost per unit output for the major customers.

The appliance and equipment sales division is often divided into two subdivisions, one of which handles the sale of major equipment, such as switches, transformers, substations, motors, etc.; the other the retail salesroom, usually called the "electric shop," which handles the sale of domestic appliances—this to include district or territory salesmen and supervisors who handle the company's direct sale of appliances to residence customers.

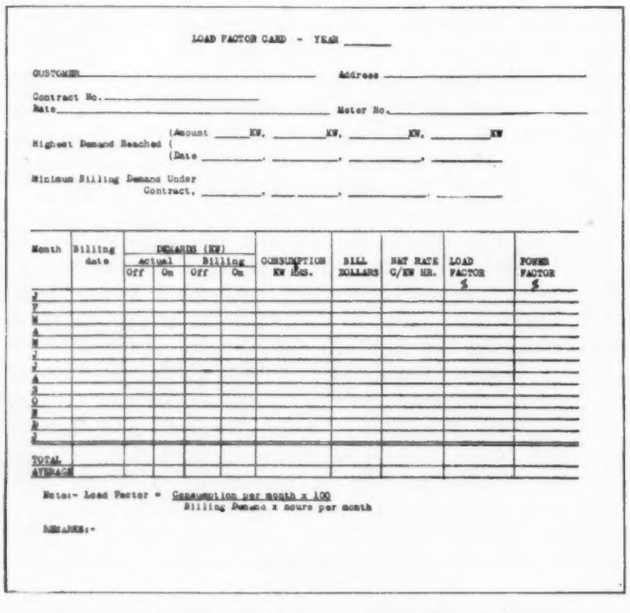
The accompanying chart shows a scheme of organization of the commercial department that permits of a definition of duties and segregation of activities into logical groups, but which maintains all commercial activity under one head. This permits close co-operation and flexibility, which will allow a temporary shifting of trained men from one division to another when the work in a division makes assistance advisable. This is not always convenient where departments are widely separated under different heads. Especially is this so when jealousy is present.

A second chart shows a plan of organization used in some cases. It differs from the first chiefly in that the domestic appliance sales department is under a separate chief; also in that the sale of heavy-duty equipment in the power sales department is handled by the individual power salesmen, whereas in the other the appliance and equipment sales division handles the sales in co-operation with the various power salesmen. The assignment of duties to power salesmen will, of course, depend largely upon the territory served. For instance, a utility in the East would have little work for a specialist on milling, but might have great need for one on textile industries.

The organization scheme should be decided upon only after careful study of conditions to be met. Once adopted, a copy of the chart should be available to all members of the department. It should show the responsibility and duties of every individual in the department. Nothing else will so assist a new member in grasping his duties and the routine of the department. Nothing will so easily assist to maintain a smoothly working machine. In addition, the department should have a manual describing briefly the work of the department, the routine orders and records, and the method of handling the business of the department.

It is essential in any organization that the head of the division select one or more of his men and train them to be able to take his place as division head in the event of promotion, sickness, vacation or resignation. The true test of management is whether or not the manager or superintendent feels that if he were suddenly called away for several weeks, his department could continue to function efficiently during his absence. The president of the company who posted the sign, "There is not a man in our employ whose services cannot be dispensed with immediately," had in mind the real criterion of organization.

The particular problems of the commercial department are: (1) to secure new customers and new business


LOAD FACTOR CARD - YEAR _____

CUSTOMER _____ Address _____

Contract No. _____

Rate _____ Meter No. _____

Highest Demand Reached (Amount _____ KW, _____ KW, _____ KW, _____ KW
(Date _____, _____, _____, _____

Minimum Billing Demand Under Contract, _____, _____, _____, _____

| Month | Billing date | DEMANDS (KW) actual Off | actual On | Billing Off | Billing On | CONSUMPTION KW HRS. | BILL DOLLARS | KAT RACK ¢/KW HR. | LOAD FACTOR % | POWER FACTOR % |
|---|---|---|---|---|---|---|---|---|---|---|
| J | | | | | | | | | | |
| F | | | | | | | | | | |
| M | | | | | | | | | | |
| A | | | | | | | | | | |
| M | | | | | | | | | | |
| J | | | | | | | | | | |
| J | | | | | | | | | | |
| A | | | | | | | | | | |
| S | | | | | | | | | | |
| O | | | | | | | | | | |
| N | | | | | | | | | | |
| D | | | | | | | | | | |
| J | | | | | | | | | | |
| TOTAL | | | | | | | | | | |
| AVERAGE | | | | | | | | | | |

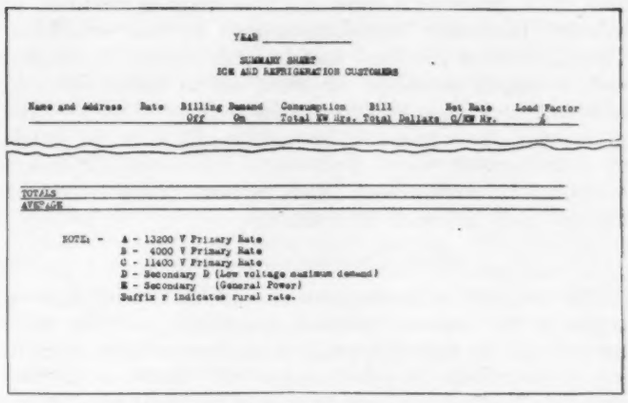
Note:- Load Factor = Consumption per month x 100 / Billing Demand x hours per month

REMARKS:-

LOAD FACTOR CARD FOR RECORD OF LARGE CUSTOMERS

in order that the utility may grow; (2) to retain old customers and to anticipate their further needs as well as to show them how to use more of the service of the utility to their own economic advantage; (3) to act as a good-will agency, adjusting major complaints and placing the utility in a more favorable light of public opinion; (4) special work in carrying out expansion or reconstruction programs where direct negotiations with the customers are necessary. To illustrate, in changing from one frequency to another or from direct to alternating current, as is often found necessary, the equipment of the customer must be listed, contracts signed, arrangements made for providing new equipment, and the actual change supervised. In so far as it affects the customer, this is the logical duty of the commercial department.

To expedite the work of the department, certain tools are advisable. First, a well-organized filing system preferably handled by one individual in each division. Ample indexes and cross-indexes should be provided. Papers should be securely fastened in manila folders and filed chronologically. Data concerning the individual customers and prospects should be entered on a record card. In addition, a complete record of the demands, consumption and billing for certain customers should be kept monthly by the power and lighting sales departments. This should include all of the larger customers and representative smaller customers in various industries. The card records thus kept are valuable in considering new business and in answering inquiries about present customers. A "load factor card" affords valuable

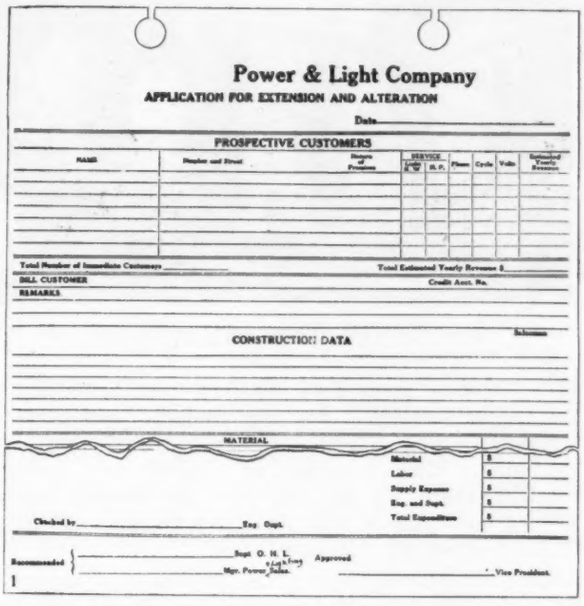

YEAR _____

SUMMARY SHEET
ICE AND REFRIGERATION CUSTOMERS

| Name and Address | Rate | Billing Demand Off | Billing Demand On | Consumption Total KW Hrs. | Bill Total Dollars | Net Rate C/KW Hr. | Load Factor % |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| TOTALS | | | | | | | |
| AVERAGE | | | | | | | |

NOTE: - A - 13200 V Primary Rate
B - 4000 V Primary Rate
C - 11400 V Primary Rate
D - Secondary D (Low voltage common demand)
E - Secondary (General Power)
Suffix r indicates rural rate.

FORM OF SUMMARY FOR DIFFERENT CLASSES OF BUSINESS


**Power & Light Company**

APPLICATION FOR EXTENSION AND ALTERATION

Date _____

PROSPECTIVE CUSTOMERS

| NAME | Number and Street | Nature of Premises | SERVICE Load K.W. | SERVICE H.P. | Phase | Cycle | Volts | Estimated Yearly Revenue |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

Total Number of Immediate Customers _____ Total Estimated Yearly Revenue $ _____

BILL CUSTOMER _____ Credit Acct. No. _____

REMARKS

Submitted

CONSTRUCTION DATA

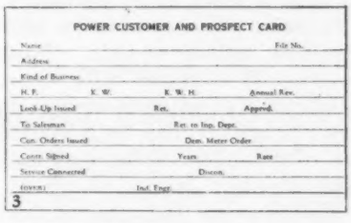
MATERIAL

| | |
|---|---|
| Material | $ |
| Labor | $ |
| Supply Expense | $ |
| Eng. and Dept. | $ |
| Total Expenditure | $ |

Checked by _____ Eng. Dept.

Recommended { _____ Supt. O. H. L. and Line Const. / _____ Mgr. Power Sales. } Approved _____ Vice President.

1


POWER CUSTOMER AND PROSPECT CARD

Name _____ File No. _____

Address _____

Kind of Business _____

H. P. _____ K. W. _____ K. W. H. _____ Annual Rev. _____

Lock-Up Issued _____ Rec. _____ Apprvd. _____

To Salesman _____ Rec. to Inq. Dept. _____

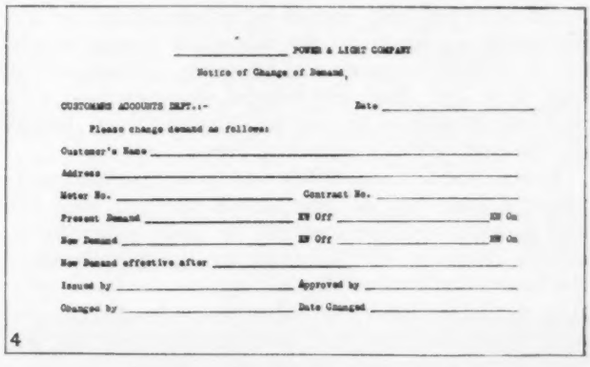
Con. Orders Issued _____ Dem. Meter Order _____

Contr. Signed _____ Years _____ Rate _____

Service Connected _____ Discon. _____

(over) _____ Ind. Engr. _____

3


_____ POWER & LIGHT COMPANY

Notice of Change of Demand,

CUSTOMERS ACCOUNTS DEPT.:- Date _____

Please change demand as follows:

Customer's Name _____

Address _____

Meter No. _____ Contract No. _____

Present Demand _____ KW Off _____ KW On

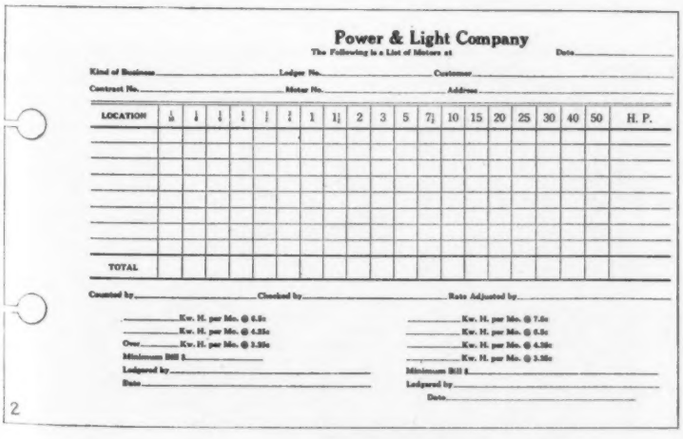
New Demand _____ KW Off _____ KW On

New Demand effective after _____

Issued by _____ Approved by _____

Changed by _____ Date Changed _____

4


**Power & Light Company**

The Following is a List of Motors at _____ Date _____

Kind of Business _____ Ledger No. _____ Customer _____

Contract No. _____ Meter No. _____ Address _____

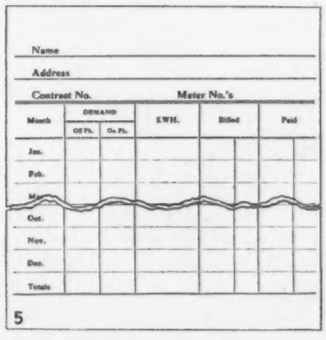
| LOCATION | ¼ | ½ | ¾ | 1 | 1½ | 2 | 3 | 5 | 7½ | 10 | 15 | 20 | 25 | 30 | 40 | 50 | H. P. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| TOTAL | | | | | | | | | | | | | | | | | |

Counted by _____ Checked by _____ Rate Adjusted by _____

_____ Kw. H. per Mo. @ 6.5c
_____ Kw. H. per Mo. @ 4.25c
Over _____ Kw. H. per Mo. @ 3.25c
Minimum Bill $ _____
Ledgered by _____
Date _____

_____ Kw. H. per Mo. @ 7.5c
_____ Kw. H. per Mo. @ 6.5c
_____ Kw. H. per Mo. @ 4.25c
_____ Kw. H. per Mo. @ 3.25c
Minimum Bill $ _____
Ledgered by _____
Date _____

2


Name _____

Address _____

Contract No. _____ Meter No.'s _____

| Month | DEMAND Off Pk. | DEMAND On Pk. | KWH. | Billed | | Paid | |
|---|---|---|---|---|---|---|---|
| Jan. | | | | | | | |
| Feb. | | | | | | | |
| Mar. | | | | | | | |
| Apr. | | | | | | | |
| May | | | | | | | |
| June | | | | | | | |
| July | | | | | | | |
| Aug. | | | | | | | |
| Sept. | | | | | | | |
| Oct. | | | | | | | |
| Nov. | | | | | | | |
| Dec. | | | | | | | |
| Totals | | | | | | | |

5

## *Forms Used in Commercial Department Work*

No. 1.—Request for estimate on extension or alteration of service indicating necessary information regarding existing conditions.

No. 2.—Record of customer's connected motor load used by billing department; a similar form is used for lighting.

No. 3.—File card for office record.

No. 4.—Notice to billing department of change in customer demand.

No. 5.—Form used to study customer's monthly demand and energy consumption.

data on a customer's record. This may be modified to suit the particular organization and its rate schedules. The data from the load factor cards should be totaled and averaged annually, classified as to industries and tabulated in a form similar to that shown. Copies of the total report thus prepared should be placed in the hands of each member of the department interested. It makes a useful reference book and permits comparisons of figures for different customers.

### Use of Technical Journals

The commercial department should have at its disposal copies of the various technical magazines, and the salesmen should be kept informed of current articles pertaining to their respective fields of work. Publications covering the various industries should be available. Close contact with the statistical department is valuable to the commercial department as augmenting its own data. Typical blanks used in power and lighting sales departments are shown in the accompanying group of illustrations. These cover practically all the usual requirements for information which is desired on standard forms or is needed for ready reference.

Routine visiting of customers is an important function of a utility sales organization. Customers as well as prospects should be visited as often as facilities permit. Some companies have in operation systems whereby each salesman reports in detail all calls. This may be and is useful in the sales of domestic appliances, but it is doubtful whether it will work or is necessary in power and lighting sales work. Too much time of the salesman is apt to be used in making reports. More money spent on transportation to expedite calls seems more logical. The writer believes that whereas written reports on major customers and prospects may be advisable, more can be accomplished by a conference between each salesman and his immediate superior once a month or oftener. The conference should cover the general field of the salesman's activities and should be supplemented by a written summary made by the salesman, giving briefly the status of each customer and prospect. Department meetings now and then are helpful if properly conducted and not allowed to become a place for trivial discussions on the part of those attending them.

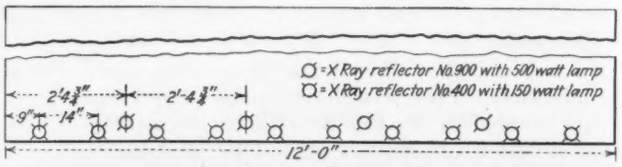
From time to time, either yearly or at most every two years, a summary of prospective load on both present and possible customers should be made either by a field survey made by the salesmen or by compilation from the records at hand as checked against the latest information available from the salesmen. By means of such a survey it is possible to concentrate upon the acquisition of the most valuable business, leaving the less valuable load as a secondary consideration. Only by means of such a survey can the work of the department be logically planned.

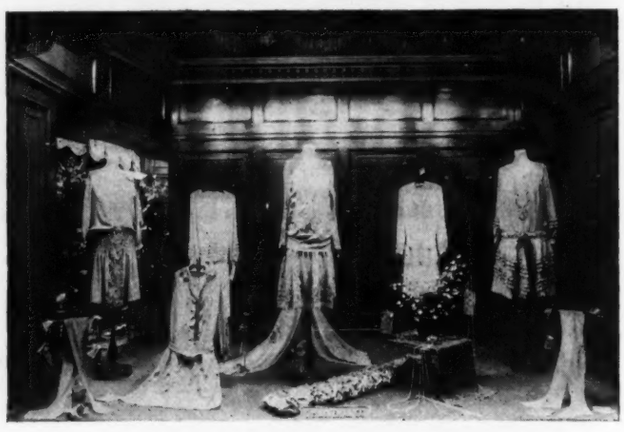
Consideration should be given to the fact that more and more the work of public relations is coming to be associated with the commercial department. Already in many organizations the commercial department handles most complaints as to billing and service. It may be advisable to add to the commercial department a fourth division to handle customer or public relations. The salesmen, who should be men of above the average intelligence, are constantly furthering public relations. Utility commercial departments could logically handle advertising, arrange plant visits, secure speakers on utility subjects, and otherwise work to win the good will of the public.

## Daytime Window Lighting Effective

TESTS made by the Tennessee Electric Power Company have proved that high-intensity show-window lighting is very effective during the daytime to dispel reflections. Data collected from the test are given in the accompanying table and show that the attractive power of the window was increased 93 per cent with high-intensity illumination.

These tests were made in one of the windows of Loveman's department store in Chattanooga, the lighting units being arranged as shown in the accompanying diagram. Regular night illumination is furnished by ten 150-watt lamps on 14-in. spacing. For high-intensity illumination



HIGH INTENSITIES USED FOR DAYTIME LIGHTING

four 500-watt lamps were installed, these being placed on 2-ft. 4¾-in. centers. For the daylight tests all of the lights were used. Tests have also been made on some of the other store windows in Chattanooga, using the regular fixtures for daylight use. All of these tests have proved conclusively that the attractiveness of the windows is materially increased.

RESULTS OF TEST ON HIGH-INTENSITY ILLUMINATION OF STORE WINDOWS

The tests were run on the following dates: Dec. 2, 3, and 6, 1926. The same display was used for all three tests.

| Time, P. M. | Lights | Number Passers-By | Number Passers-By Attracted | Passers-By Attracted, Per Cent |
|---|---|---|---|---|
| 2 to 2:30 | No lights | 948 | 109 | 11.4 |
| 2:35 to 3:05 | All lights | 929 | 177 | 19.0 |
| 3:10 to 3:40 | No lights | 1,177 | 117 | 9.9 |
| 3:45 to 4:15 | All lights | 994 | 191 | 19.2 |
| 2 to 2:30 | All lights | 976 | 184 | 18.8 |
| 2:35 to 3:05 | No lights | 978 | 70 | 7.1 |
| 3:15 to 3:45 | All lights | 1,111 | 100 | 14.4 |
| 2:30 to 3:00 | No lights | 1,146 | 69 | 6.0 |
| 3:15 to 3:45 | All lights | 1,230 | 148 | 12.0 |

| | |
|---|---|
| Average number passers-by per half-hour with lights on | 1,048 |
| Average number attracted per half-hour with lights on | 172 |
| Average number passers-by per half-hour with no lights | 1,062 |
| Average number attracted per half-hour with no lights | 91 |
| Average per cent attracted per half-hour with lights on | 16.6 |
| Average per cent attracted per half-hour with no lights | 8.6 |
| Increase in attractive power of window with all lights on over window with no lights on, per cent | 93 |
| Cost of lighting window for half-hour with full wattage, cents | *3.5 |
| Cost per increased persons attracted with high-intensity lighting over no lights, cents | 0.043 |

*These figures are based on a rate of 2 cents per kilowatt-hour.

# Distributing Goods Through a Bonded Warehouse*

By Charles L. Eidlitz
*Chairman Board of Governors*
*Electrical Board of Trade of New York*

WHAT is the loss to the industry because of slow-moving stock? Is there not a remedy or help for it? Assume, for argument's sake, that there are 1,000 jobbers and dealers in the metropolitan district. Each one must carry a stock of thousands of items, and many items must be carried in large quantities. This means two things—a large outlay of money to purchase the stock, and an expense for warehousing or stocking space. If a way could be found for relieving this condition in the industry, yet making the stocks immediately available to all the adjacent markets, would it not be a great saving all around?

The manufacturer, on the other hand, who distributes through these channels, must make up large quantities in order to furnish the stock to these many sources. Now a manufacturer, as a rule, is not very greatly interested in having his products on some man's shelf in a dust-covered or dilapidated condition, even if it is paid for. He wants his material sold and moved in order that the supply of new orders shall come in steadily. Yet, in many lines, the fact is that certain distributors buy their stock and then do not move it, owing to several reasons. They may not have the kind of trade that requires these lines, or they may be particularly active in some specialties, making very little effort to sell the other materials, or they may be lazy and incompetent, but the net result is that the manufacturer has thousands of dollars' worth of his material, paid for but still not being consumed, while other jobbers or dealers are calling for more and more on re-orders. And then, suddenly, these slow-movers are sold at a bargain or at a bankrupt sale by the company which has been unable to dispose of them through its ordinary channels for one reason or another, completely demoralizing the market.

It is quite possible that certain materials might find a better market in a different locality, such as Philadelphia or Chicago and, when these calls come in, if the manufacturer could gather up his surplus or slow-moving stock from the inactive jobbers or dealers, which he cannot do at the present time, and put it where it would be consumed, instead of having to manufacture more of it, his situation from a manufacturing standpoint would be greatly improved. I am confident that there is a solution to this problem of distribution and would suggest that some consideration be given to the establishment of a bonded warehouse, operated possibly by the Electrical Board of Trade, or some other agency. Manufacturers could ship in a quantity of material to take care of the requirements of the metropolitan district, under bond. The individual jobber and dealer would buy only a small supply, which would be shipped directly. Whenever they needed a stock, they could order it out of the bonded warehouse, and the manufacturer could give instructions as to the honoring of such orders. The warehouse would deliver, take a receipt and send the manufacturer the receipt, so that he could bill direct. The manufacturer would thus be in direct control of his goods, could shift them in any desired quantity to other neighborhoods, his investment would be smaller and the jobbers' money would not be tied up. There are innumerable banking, financial and other benefits that would result from this plan, to say nothing of reducing frozen assets by 50 per cent or more.

Of course, there are many details that must be worked out, but it does seem that there is enough in the idea to warrant giving it consideration. The cry nowadays is "simplification and economy in distribution." To my mind, the bonded warehouse is one answer to this distribution problem.

*From an item appearing in the service letter, Vol. 4, No. 52, of the Electrical Board of Trade of New York, Inc.*

## Attractive Sales Quarters in Portland, Ore.

ONE of the most attractive merchandise salesrooms of any central station on the Pacific Coast is that of the Northwestern Electric Company in the new Public Service Building, Portland, Ore. High-intensity lighting is one of the special features. The sales floor is approximately 75 ft. x 100 ft. and has an average intensity of 22 foot-candles with 6 watts per square foot of floor area provided by eight 1,500-watt and 32 500-watt Ivanhoe "Celestialite" units.

Spacious windows and special attention given to show cases and arrangement of display give the whole room a pleasing ensemble effect.

APPLIANCE DISPLAY ROOM OF NORTHWESTERN ELECTRIC COMPANY, PORTLAND, ORE., HAS 22-FOOT-CANDLE LIGHTING INTENSITY

# Letters from Our Readers

## *Transmission Line Insulation*

*To the Editor of* ELECTRICAL WORLD:

It is impossible for engineers familiar with modern laboratory methods used in the testing and design of high-voltage insulators to read Mr. Austin's article, "Transmission Line Insulation," without comment.

It is a recognized axiom that laboratory data are only applicable in the solution of field problems when they account for all the factors which are encountered in the field without addition or subtraction. At the present time there are ample field data to prove that sustained high frequency does not exist upon transmission lines. Moreover, by a simple calculation it can be shown that the power necessary to maintain on a line high frequency of a sufficiently large voltage to cause insulator flashovers would be so great as to preclude such a possibility. Be that as it may, the weight of the evidence indicates that the existent surges are of a single impulse or highly damped character of relatively low frequency.

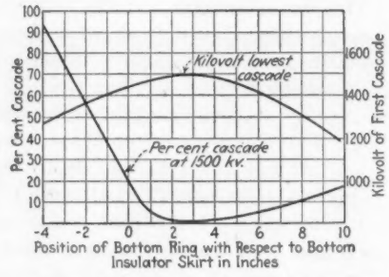
Unfortunately, much of the evidence presented in Mr. Austin's paper deals with the use of a sustained high frequency of 70,000 cycles. In this connection the author states: "This class of test has been questioned, but it must be remembered that where wood is used in series with an insulator this test will give lower values than an impact having a very steep wave front." It is not a matter of being "questioned." It just cannot be accepted as anything more than an interesting exhibition of a certain type of air breakdown, entirely unrelated to the problems at hand. Since sustained high frequency of 70,000 cycles does not exist in the field, laboratory results based on the use of such a source of power are of academic interest only.

Those who have made a study of the arcing characteristics of different types of alternating current and surges realize that the mechanics of breakdown of air gaps when subjected to a steep voltage wave front or 60 cycles is entirely different than with 70,000 cycles.

The failure of the air in the latter case is due to the persistence from cycle to cycle of ionized particles in the path of the discharge. This is not so with the two former types of voltage breakdown. Evidence of this is shown in Fig. 1* of Mr. Austin's article. Unfortunately, for the sake of comparison the tower clearances about the two strings shown are entirely different. It can be clearly seen, however, that by dampening the corona with cages about the conductor and by putting porcelain tips on the arcing horns of the string shown in the left of the photograph that the initial corona point is raised, which consequently tends to prevent the ionization of the air and resulting progressive failure. No doubt the flashover of the string as regards sustained high frequency may be considerably raised by such methods. As already stated, however, such an exhibition is of interest only as a bit of electrical phenomena. Furthermore, the different tower clearances prevent it from being, as the title states, "comparative test at 70,000 cycles." In view of these facts the value of the flashover results in Fig. 4 may well be questioned.

The impact tests shown in Figs. 10*, 11* and 12* cannot go unchallenged. These tests purport to be an impact of 1,280,000-volt peak. The voltage and energy of the impulse arc are stated, but no mention is made of the time taken for it to reach a maximum. Those in touch with matters of this nature will realize the importance of this factor. In Fig. 11* the protective device shown is so placed that its value is entirely lost. From the accompanying curve it can readily be seen that this device is dependent entirely on position for the character of its performance. This curve was arrived at only after repeated tests. Any one familiar with impact tests of this type understands how important it is for a number of tests to be given. It is perfectly possible to have a string of insulators equipped with protective devices which would clear an arc nine times out of ten and yet cascade on the tenth impulse. No single picture can possibly tell the whole story.

Mr. Austin's "counter-potential wire" is quite interesting, but apparently not very practicable. The scheme as outlined is to have the line insulators mounted on supports insulated from the ground. These insulated portions are to be bonded together by a wire paralleling the transmission conductors. The theory depends upon the idea that a surge will raise the potential of the insulator supports to a potential corresponding to the conductors because of the charge induced upon this "counter-potential wire." This action is supposed to prevent flashovers. In case of wood-pole construction some such effect might be produced under dry conditions. Unfortunately, Mr. Austin has ignored rain conditions despite the fact that most predatory surges take place under such conditions. Wet wood poles would convert Mr. Austin's wire into nothing more than a poorly grounded ground wire.


Per Cent Cascade
Kilovolt of First Cascade
Kilovolt lowest cascade
Per cent cascade at 1500 kv.
Position of Bottom Ring with Respect to Bottom Insulator Skirt in Inches

ARCING CHARACTERISTICS OF FOURTEEN NO. 7,500 INSULATOR UNITS IN SERIES

Mr. Austin increases the field of application of this device to include lines of steel tower construction. In Fig. 13† of his article is shown a steel tower, the top of which is insulated from the base by means of wooden beams. In the case of such towers the "counter-potential wire" is supposed to raise the voltage of the whole top of the tower to a potential comparable to that of the conductors.

Because of the large capacitance to ground of all the metal work involved and because of the fact that at the moment before the release of the bound charges on the conductors the top of the tower might actually be at a potential below or above ground it is not conceivable that the "counter-potential wire" would function at all as outlined. Rain, of course, would have the same bad effect as in the case of the wood poles.

The use of an insulated ground wire is undoubtedly a good idea under certain conditions. In fact, the whole idea is making use of the insulating effect of wood construction, which, while new, is worth attention.

It is unfortunate that the data contained in Mr. Austin's article are clouded by the methods of test used and the lack of recognition of contemporary research.

**Locke Insulator Corporation, Baltimore, Md.**

D. H. ROWLAND,
Research Engineer.

* ELECTRICAL WORLD, *Dec. 24, 1927.*
† ELECTRICAL WORLD, *Dec. 31, 1927.*

# Digest of Electrical Literature

## *Hydro-Electric Development and Steam Equipment*

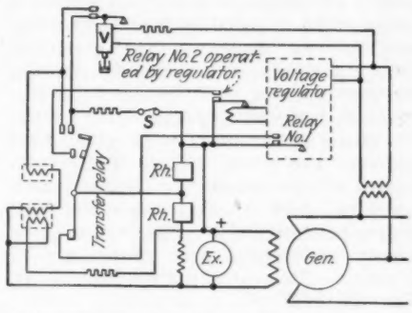
*Vernayez Hydro Station.*—The present capacity of this plant, which serves primarily to supply part of the Federal Railway electrification of Switzerland, comprises two 11,000-kva., $16\frac{2}{3}$-cycle, single-phase generators and one 14,000-kva., 50-cycle, three-phase machine, driven by Pelton wheels under a head of 2,000 ft. of water. All three generators operate at $333\frac{1}{3}$ r.p.m. The large size of the machines made it necessary to build the stator in four parts. The highly insulated and heavily braced winding gives a potential of between 15 and 16.5 kv., and was tested at 39 kv. Each of the six poles is held in the five rotor hub plates by means of special wedges, seated in carefully machined circular slots. The pole face is laminated and carries a strong damper cage. The pole winding consists of two concentric edge-wound copper strip coils. At 0.75 power factor and full load the single-phase generators have an efficiency of 92.7 per cent. Automatic $CO_2$ fire-extinguishing equipment is installed on each generator.—*Bulletin Oerlikon,* December, 1927.

*Combined Low Temperature Carbonization and Combustion.* — DAVID BROWNLIE.—Two defects in electricity supply practices are mentioned in connection with steam generation, the loss due to latent heat in the condenser cooling water and the combustion of raw coal under the boilers. In discussing the combustion problem, the use of a combination of low temperature carbonization and combustion, which submits coal to suitable heat treatment previous to the use in the boilers and separates liquid products before burning both gas and fuel in the combustion chambers is advocated. A description of low-temperature carbonization plants which have been in successful operation for some time is followed by an exposition of some of the more recent developments of the basic processes involved. The new Bartling process is suggested as a most interesting development in low temperature carbonization of pulverized coal. This process has been used with a special separator for the elimination of solid particles from the gas.—*World Power (England),* December, 1927.

*The Effect of Heat Treatment on Cold-Drawn Steel Tubes.*—F. C. LEA.—The extensive use of cold-drawn steel tubes in modern machines and structures renders the adequate investigation of their properties a matter of considerable importance. Boiler tubes, it is stated, are not infrequently overstrained in order to increase their length and to make it possible to reuse them after being cut from the tube plate. The test investigation covers the statical and repetition-stress tests on carbon-steel tubes and includes compression tests, torsion tests, changes of density under heat treatment, hardness tests, the effect of repeated stresses, the effect of gradually increasing the repeated stress and similar factors of a significant nature.—*Engineering (England),* Dec. 23, 1927.

## *Transmission, Substation and Distribution*

*Protection from Overvoltage Due to Voltage Regulators.*—J. H. ASHBAUGH.—In the event that regulator contacts become stuck voltage may be raised to a high value. This is often a direct result of excessive condenser capacity across the contacts. It is stated by the author that excessive capacity used for contact protection will produce a large current, which, together with a relatively high resistance, induces a welding




TRANSFER RELAY PLAN PREVENTS REGULATOR OVERVOLTAGE

action. As the tendency to weld increases with the amount of condenser capacity used, difficulties may be reduced by a curtailment of condenser capacity. Several methods and devices may be employed to eliminate this welding action with ensuing high-voltage conditions, but most of them have limitations. A scheme is now available for the protection of small stations whereby they may be assured of continuity of service without any hazard of overvoltage due to the failure of regulator contacts. The device is quite simple and may be added to any existing installation. It consists of adding an auxiliary rheostat shunting relay, actuated by the regulator, to which is transferred the regulating duty if the contacts of the regulator relay should stick together. This device has a time delay feature which prevents the transfer from taking place for transient voltage changes due to load variation. The time delay is adjustable to suit the individual station or load conditions. The transfer must be smooth and exceedingly fast. In case of overvoltage, the regulator brings the voltage back to normal with all the speed for which the vibrating regulator is noted.—*Electric Journal,* November, 1927.

## *Generation, Control, Switching and Protection*

*The Application of Relays for the Protection of Power System Interconnections.*—L. N. CRICHTON and H. C. GRAVES, JR.—A compilation of many of the new methods for relay protection required by superpower interconnections. The ideas have been obtained from various sources and represent present-day practices. The general requirements for such interconnections are mentioned, with particular reference to protection against phase-to-phase short circuits in those cases where the short-circuit current, under certain system conditions, is less than the full-load current under other conditions. The clearing of accidental grounds is discussed and a new study of the residual currents on systems of different types is given. The usefulness of certain inverse time limit relays on systems having dead-grounded transformer neutrals at all switching stations is indicated. A typical relay installation is offered as an example and is similar to that now being placed in service on a 200-kva. interconnection.—*Report American Institute of Electrical Engineers,* November, 1927.

*De-Excitation of Large Generators.*—R. POHL.—Two basic methods are known to quickly de-excite large generators—the introduction of resistance and the motor method. The latter, in most instances, utilizes the exciter as a motor with its field reversed and is then combined with the former. Both methods are critically investigated in this discussion. It is stated that at the same voltage peak on the collector rings the methods are equally fast, providing that the exciter operates as main motor with moderate iron saturation. Conditions may be improved if the motor is provided with constant excitation and is highly saturated during the period of de-excitation. The important influence of the damper winding on large turbo-generators is investigated. It is shown to be permissible to open the inductor circuit directly on large generators without undue increase of the voltage on the collector rings. This gives a simple and effective means of de-excitation. — *Elektrotechnische Zeitschrift,* Nov. 24, 1927.

## *Motors and Control*

*Protection Systems in Coal Mines.*—E. P. AUSTIN.—The practices involved in the wiring and protection, through relays and similar devices, in the coal mines of Great Britain are reviewed. Among the conclusions derived as a result of this investigation are: Neutral points should be grounded, leakage and overload protection should be used on each main feeder and sub-feeder, pumps and large haulages should have separate

feeders so that faults on distribution cables will not affect these important units and fuses should be used only on single-phase, low-voltage circuits. It is stated that greater safety below ground would result if the existing rules were supplemented along the lines indicated so that there would be a definite uniform standard for every mine.—*Electrical Review (England)*, Dec. 23, 1927.

## *Electrophysics, Electrochemistry and Batteries*

*The Boltzmann-Hopkinson Principle of Superposition.*—F. D. MURNAGHAN.—The principle of superposition for dielectrics, discussed by Hopkinson, has been used for some time in experiments. The validity in regard to the several theories which have been advanced for dielectric behavior has been shown in only a few cases. One of these exceptions is the important theory of Maxwell. This paper shows that the principle of superposition is a necessary consequence of Maxwell's theory. It goes somewhat further and shows that the principle is valid for any theory which leads to a system of linear differential equations with constant coefficients.—*Journal American Institute of Electrical Engineers.*—January, 1928.

*High Voltage Insulators.*—W. HUTER.—A detailed critical review of the various types of insulators and leads, such as are used today on high-voltage apparatus, including bushings and post insulators. Single-piece and two-piece air and compound filled porcelains are described and data given on the dielectric properties of filling compounds. The characteristics of oil-filled bushings are discussed in connection with the great improvement realized through the introduction of solid cylinders in series with the oil. Condenser type paper leads and multiple tube porcelain bushings are described. Examples of failures are offered for each type.—*Elektrotechnische Zeitschrift*, Nov. 3, 1927.

## *Units, Measurements and Instruments*

*33,000-Volt Cable Testing.* — M. HOCHSTADTER and E. BOWDEN.—A review of present day high potential cable-testing practice and a suggested specification of factory and installation tests embodying a combination of the usual methods. The specification as offered is based upon a large amount of experience and it is considered that the conditions are wide enough to be met by all manufacturers with modern plant and reasonable care in design and manufacture and at the same time strict enough to safeguard the interest of the buyer in his endeavor to obtain a cable that can be relied upon to give satisfactory service. The factory test suggested includes dielectric resistance, pressure, capacity, dielectric loss, breakdown, bending and stability. The installation test includes pressure, dielectric resistance, current rating, and joint and terminal box pressure test. It is suggested that these tests be taken under conditions such that the wave form of the supply be as nearly as possible of sinusoidal shape.—*Electrical Review (England)*, Nov. 25, 1927.

## *Telegraphy, Telephony, Radio and Signals*

*Design and Application of Giant Loud Speakers.*—F. TRENDELBURG.—The author gives a mathematical explanation of the phenomena involved when mechanical energy is transformed into acoustical energy. The ideal sound emitting surface is a sphere, or, as the author calls it, a "breathing sphere." Approximations to it are cones, circular diaphragms and large square surfaces. Small cones and diaphragms require mechanical sound amplification by means of a horn. Characteristics of paper and metal horns are given, indicating their varying sensitiveness depending upon the sound frequency. It is claimed that for large sound energies, such as are required by public address speakers, the condenser type with an emitting sheet 20 x 20 in. gives best results with a minimum of distortion within a range of 50 to 8,000 cycles. Interesting semi-circular diagrams are given to show the directional sound distribution for two types of such speakers for frequencies between 200 and 7,000 cycles. Operating experiences with giant loud speakers are given. Tests made in a stretch of open country indicated that a hornless sheet speaker, as mentioned above, permitted the spoken word to be clearly understood over a distance of ½ mile. — *Elektrotechnische Zeitschrift*, Nov. 17, 1927.

## *Traction*

*Economies Effected by the Electrification of the Paulista Railway.*—S. B. FORTENBAUGH.—Data for the electrified Paulista Railway of Brazil are offered, with comparisons of previous operating expenses for the same railway when using other means of motive power. The comparative figures thus included cover a period of several years and have been reduced to a train-kilometer basis and evaluated upon the same plan. As wood, coal and oil were all used under the previous operating conditions, unusually interesting comparisons have been developed.—*General Electric Review*, December, 1927.

*Electrical Equipment of Electric Road Vehicles.*—L. W. DE GRAVE.—Features involved in the design and operation of electric trucks are considered in relation to operating economies and reliability. The relative merits of battery control through resistance and resistance control are discussed. The question of shunted-parallel fields, as well as brake interlocks, regenerative control, electric brakes and the specifications of controller contacts and fingers are considered. A brief consideration of the most economical operating procedure is offered. — *The Electrician, (England)*, Dec. 9, 1927.

## *Miscellaneous*

*A Study of the Compressive Strength Dispersion of Materials with Applications.*—JOHN TUCKER, JR.—The express purpose of this article is to propound a theoretical fundamental theory for the compressive-strength dispersion of homogeneous isotropic materials and to substantiate these theorems by previously published relevant data, where available, and by specially prepared specimens where no data exists. The strength dispersion to which reference is made are those variations from the mean, exhibited in the ultimate strengths of individual test specimens made of a uniform material and under uniform conditions, for which there are no assignable or controllable causes. Basic experimental data, from which the ultimate strength dispersion parameters may be computed, are very meager, since a large number of multiplicate test specimens are necessary to determine these parameters with a satisfactory degree of precision. In order to obtain the necessary data, portland cement mortar and concrete were selected as the materials, and a number of test cylinders of these materials were made and tested in compression. As a result of this investigation, the author states that the strength dispersion has been found to be an essential factor in safe-stress determination, and that the strength-frequency curve is of the normal form, or very close to the normal form, and of such character as to permit its use in engineering calculations. —*Journal of The Franklin Institute*, December, 1927.

*Temporary Safety Grounding.*—A review of desirable practices in connection with temporary grounding methods as used by a number of the leading electric light and power companies. The grounding practices involved in connection with all types of electric equipment are included. As the result of the investigations of this committee it is concluded that every company should have a set of rigid rules and instructions for temporary grounding, adequate equipment should be provided and regularly inspected and maintained by a competent employees, instruction and training in grounding methods as approved should be given employees and temporary grounding should be performed under close supervision.—*Serial report Accident Prevention Committee, National Electric Light Association*, October, 1927.

*Physical Properties and Methods of Test for Sheet Brass.*—H. N. VAN DEUSEN, L. I. SHAW and C. H. DAVIS.—An investigation undertaken to secure a simple and reliable method of test for thin-sheet non-ferrous metals. Considerable attention has been given to the Rockwell tester, which, as the result of this work, has been found satisfactory for use as a specification instrument for brasses 0.020 in. and thicker when used under standardized methods of test and calibrated in terms of a standard instrument.—*Reprint B-269, Bell Telephone Laboratories, Inc.*

# News of the Industry

## Walsh Modifies His Resolution

### Senator Himself Suggests Limitation Eliminating from Proposed Inquiry Intrastate Non-Subsidiary Companies—Cortelyou and Addinsell Testify

By Paul Wooton
*Washington Correspondent of* Electrical World

INDICATIONS are, as this is written, that the Senate committee on interstate commerce will conclude its hearings on the Walsh resolution before the end of the week. The prospects are that the committee will recommend an investigation of those phases of the electric and gas utility businesses which clearly come within the jurisdiction of the federal government, but the case made against even such an investigation is considered so strong that there is doubt whether the Senate itself will approve the resolution, however modified. Senator Walsh himself proposed the limitation, which is carried in a proviso he intends to add to his resolution. It follows:

"Provided that nothing herein contained shall be deemed to authorize the committee to inquire into the affairs of any corporation engaged wholly in intrastate business not being a subsidiary of or whose stock or operations are not held or controlled to some extent by another corporation."

Senator Walsh's proposal led to an animated discussion among members of the committee in which Chairman Watson, Senator Hawes of Missouri and Senator Sackett of Kentucky were the chief participants. Senator Watson said: "I think the terms of the resolution itself ought to fix its extreme boundaries and its widest limitations, and that they ought to be compelled within those boundaries of limitations to make this inquiry and not trust to the whims, if you will permit me to use that expression, of the members of the committee." Senator Walsh replied that the limitations of the resolution could not well be fixed more definitely. "I think you can safely trust to the good sense and the good judgment of the committee with respect to these matters," he said. Senator Hawes and Senator Sackett took issue with him, Senator Sackett objecting to requiring "an intrastate holding company to come into court to maintain its rights under the Fourth Amendment, without any reason or power, apparently, in the federal government to force it to do it." To this Senator Walsh replied:

"If their stocks were not sold in the market, that might be the case, but even so, in order to legislate with relation to the general subject of those that are engaged in interstate commerce, should we not have an opportunity to inquire about how they do their business? Maybe it would serve as a good guide for any legislation. They may operate their business so well and so efficiently and so securely that we ought to enforce a similar system upon other companies."

#### Cortelyou Gives Testimony

When the hearing before the committee was resumed on Friday, Jan. 20, former Secretary of the Treasury George B. Cortelyou, now president of the Consolidated Gas Company, New York, and chairman of the Joint Committee of National Utility Associations, testified. He explained that the utility companies disapproved of the proposed inquiry on three grounds—first, that no facts showing an investigation to be necessary have been presented; second, that the Walsh resolution is too broad in its scope, and, third, that Congress lacks jurisdiction to either investigate or legislate on most of the points raised in the resolution.

Mr. Cortelyou contended that the people have been the gainers whenever a group of power companies have combined for economic reasons. Improved service and lower rates have invariably followed, he said. Combinations became imperative when the demands of industry in general became so heavy that in many cases local supplies of capital proved insufficient to meet the increased demands, the witness testified. This drift toward consolidation of the smaller companies began during the World War and has been growing ever since. Many hundreds of millions of dollars more will be required, he said. Pointing out that municipalities and states impose strict regulations on the companies and require periodical and comprehensive financial and other reports, Mr. Cortelyou maintained that the industry is "almost constantly under what could be called investigation."

H. M. Addinsell, vice-president of Harris, Forbes & Company, New York bankers, after outlining to the committee the thorough investigations his firm makes before undertaking to sell utility bonds, expressed the opinion that such bonds are the safest and best securities available. He mentioned preferred stocks of public utilities also as safe. Senator Dill asked what the studies made disclosed as to the securities of holding companies, and the witness replied these securities were not so preferred a risk, since they came after the bonds and stock of the companies controlled. He expressed satisfaction with the policies of holding companies.

At a later hearing James A. Emery, general counsel of the National Association of Manufacturers, appeared in opposition to the resolution, on behalf of manufacturing industries "concerned in the nature of the power which the Senate is likely to grant to a committee of that body for the purpose of inquiring into the private affairs of individuals and corporations." Mr. Emery brought out the point that the investigation certainly would extend into investment trusts. He called attention to a decision by the Supreme Court which held that "a fishing expedition into the affairs of a stranger for the chance that something discreditable may turn up is forbidden."

#### Letter from O. D. Young

Senator Walsh presented to the committee a letter to him from Owen D. Young which indicated that the General Electric chairman had a different idea of congressional investigations from the one indicated in an article printed in the Brooklyn *Eagle* and which quoted Mr. Young. In his communication Mr. Young said:

"So far as the General Electric Company is directly concerned, if any charges are made by you or by other responsible persons through you against it, I have no objection to any resolution authorizing investigation of the General Electric Company, however sweeping its terms may be. A resolution to investigate the General Electric Company is a specific inquiry. When one starts to investigate an entire industry, however, that is another matter. The resolution, in my judgment, authorizing the investigation should be to investigate specific questions affecting the industry which are clearly set forth and defined. That is especially true if the inquiry relates to any question which may affect credit. To impair the credit of any industry would be a public calamity."

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## New 80,000-Kw. Generator for Milwaukee

A turbo-generator with a rated capacity of 80,000 kw. will be installed this year at the Lakeside power plant, according to John Anderson, vice-president of the Milwaukee Electric Railway & Light Company. It will be the largest unit in Wisconsin and is expected to be in operation by Nov. 1. Including auxiliary equipment and necessary extensions to the power house, it will cost $1,461,000. Preliminary work on the extension of the building has been started. The new section will be 72 ft. long, 94 ft. wide and 75 ft.

high. With the addition the building will be 375 ft. long. The unit will be twice as large as any of the present generators at Lakeside. It will increase the capacity of the station to 227,000 kw.

## Boulder Dam Before a Senate Committee

*Senator Johnson Attacks Power Companies and the Joint Committee of National Utility Associations as Sources of Adverse Propaganda*

A FAVORABLE majority report on the Swing-Johnson Boulder Dam bill will be made to the House of Representatives after Feb. 1, Chairman Smith of the irrigation committee now thinks. The probability is that Representative Douglas of Arizona will make a minority report. The Senate committee on irrigation and reclamation has begun its consideration of the measure, and Governor Dern of Utah has repeated before it the plea he made to the House committee that legislation be withheld pending another attempt by the seven Colorado Basin states to reach an agreement. Governor Dern predicted that under a six-state agreement, such as is proposed by California, Arizona would get all of the upper basin water and California would get all of the lower basin water, thus completely depriving the upper basin states of their water rights.

The Muscle Shoals issue was injected into the discussion by Senator Dill of Washington. He wanted to know why, if the principle is established at Boulder Canyon of allowing the states to collect power royalties, the same idea could not be applied to allow Alabama to collect similar charges on the nitrates that may be manufactured at Muscle Shoals. Governor Dern said that he had not considered this question, but that he was not advocating any rights along the Colorado that could not be applied at other places.

Regarding a statement made by Governor Dern that the charges of power propaganda behind the opposition are a smoke screen, Senator Johnson asked the Governor if he was really acquainted with some of the propaganda that was being turned out. "Are you familiar with the things being turned out by the organization known as the Joint Committee of National Utility Associations, whose headquarters are at 420 Lexington Avenue, New York?" he asked.

Thomas Maddock, former State Highway Engineer of Arizona, and John L. Gust of Phoenix, representing the water users of the Salt River Project in Arizona, spoke in opposition to the bill. George W. Malone and C. P. Squires, members of the State Highway Commission of Nevada, said their state favored it, provided there was an assurance of reasonable revenue. Governor Emerson of Wyoming spoke in opposition to the measure as it now stands.

# Merchandising Holds Stage at Chicago

### N.E.L.A. Commercial Committee Members Discuss Plans and Hear of Progress Made in Many Directions to Formulate Proper Selling Policy

MERCHANDISING held the center of the stage at the three-day meeting held on Jan. 18-20 of the eleven committees of the N.E.L.A. Commercial National Section at the Edgewater Beach Hotel, Chicago. Chairman Greenwood of the general merchandising committee presented three features of unusual interest. He reported the satisfactory conclusion of a series of intertrade conferences which have been participated in by the national officials of the various retail trades merchandising electrical household appliances, the purpose being to develop a common understanding of some of the principles of merchandising policy in which there has been conflict between the power industry and the retail trades. Through these meetings certain fundamentals have been defined which are acceptable to all and which received the signature of the representatives of dry goods, hardware, furniture and druggists' associations. This agreement was approved by the executive committee of the Commercial National Section, but is not yet released for publication.

The merchandising committee also reported and received approval on the program to conduct a series of laboratory and field tests to determine the load and service characteristics of the oil burner. Laboratory tests will be conducted in an independent laboratory to which manufacturers may bring their equipment for test under standard specifications which will be established by a joint committee of the National Electric Light Association, the Association of Edison Illuminating Companies and the Oil Heating Institute. The field tests will be conducted in about six cities under the specifications and direction of this joint committee. The committee also announced the ten-thousand-dollar prize contest details of which are given on this page.

The power committee is at work on serial reports that will analyze competitive power conditions in a number of industries such as flourmills and woodworking plants. The electrical advertising committee reported the organization of two schools to be conducted in March, one at Harrison, N. J., and one at Cleveland, to provide a special course of training for central-station salesmen in developing electric sign load. The home-lighting committee indorsed the program of the Industry Sales Conference, which is now developing a sales plan for the electrical industry in the residence field. This committee has collected a compendium of experience in refixturing, which will soon be published as a serial report. The lighting service committee discussed the present slump in industrial lighting and the need of establishing continuity in the development work in this field. It is planning organized co-operation of the architects, and also to correlate the work of the lighting and power salesmen of the utilities, realizing that 50 per cent of the energy sales to some industrial customers consist of lighting.

The wiring committee also indorsed the program of the Industry Sales Conference and approved the program which the manufacturers are carrying forward in developing uniform ordinances throughout the country. A resolution was passed protesting against the delay in the approval of thin-wall conduit for use under the National Electrical Code and demanding a stronger official status for the representative of the N.E.L.A. on the electrical committee. The committee also recorded its disapproval of the inclusion of Safety Code rules in the National Electrical Code. The transportation committee discussed holding a national conference to consider possibilities for the development of battery-charging load, the particular purpose being to demonstrate to the power companies the importance of utilities using electric trucks in their own transportation service. The refrigeration committee approved an advertising program which had been developed by Chairman Richardson. The domestic range committee reported progress on development of a range sales manual and considered the development of an advertising campaign similar to that under consideration for refrigeration. The promotional rates committee held an experience meeting on the effect of the inducement type of rate on the increase of residence consumption. The industrial heating committee obtained an appropriation for the development of a motion picture.

Chairman Davidson announced that the appointment of a commercial executive to be added to the headquarters staff of the National Electric Light Association would probably be made within a few weeks. The attendance at this meeting was unusually large, 209 men being registered.

## "One More Kilowatt-Hour per Home per Day"

An immediate campaign to bring about the consumption of one more kilowatt-hour per home per day all over the nation has been launched by the general merchandising committee, Commercial National Section, N.E.L.A. At the present time the average individual residence consumption throughout the country is 400 kw.-hr. a year, or slightly over one kilowatt-hour per day. This produces an average annual revenue less than $30, which the committee thinks scarcely half enough.

At the suggestion of the committee, a fund of $10,000 is being subscribed, chiefly by the manufacturers of electri-

cal equipment and apparatus, to provide $9,000 in prize money and $1,000 for the expenses of the contest. Three first prizes of $2,000 and three second prizes of $1,000 are offered to member companies, grouped in three classes as follows, according to their present average annual energy sales to residence customers: Class A, 451 kw.-hr. or over; class B, 351 to 450 kw.-hr.; class C, 350 kw.-hr. or under. Cash prizes of $2,000 or $1,000 will therefore be won by the sales departments of the six power companies that in 1928 show the best and next best increases in average consumption per residence customer in their respective classes.

## Local League Officials Discuss Their Problems

A special midwinter conference of officials of local leagues was held last week at the offices of the Electrical Association in Chicago to provide an opportunity for the discussion of the practical details of league operation and development. Seventy-three league men were present, representing thirty-five leagues from Boston to Denver and from Winnipeg to New Orleans.

The discussion embraced a wide variety of league problems, such as central-station dealer financing, labor, ordinances, radio sections, non-electric members, the "curbstone" contractor, compensation of field men and how to keep members "sold." The most important theme was the "red seal" plan and the need for a national specification that will permit broader use of the "red seal" idea in national advertising and in house plans sold by the national services. The conference approved the program for uniform specifications.

In a general review of league experience, methods for promoting industrial, commercial and domestic lighting were discussed and the responsibility of the leagues for the education of the small housewiring contractor had particular consideration.

The four sessions were presided over by J. E. North, Cleveland; Burke Corcoran, Chicago; D. C. Birdsell, Philadelphia, and Earl Whitehorne, New York.

## East Central Division Takes Up Commercial Topics

Opportunities for building additional loads and methods of obtaining this business by central-station companies occupied the attention of about one hundred utility executives and commercial managers at a Commercial Section meeting of the East Central Division, N.E.L.A., at the Hotel Statler, Cleveland, on Jan. 23. Pointing to the low average kilowatt-hour consumption per domestic customer, T. O. Kennedy, vice-president and general manager Ohio Public Service Company, drew a picture of possibilities for load development, while H. W. Derry, section chairman, presented a graphical analysis of industrial electrification, showing that while approximately 73 per cent of the industry is electrified, only 44 per cent of industrial power is purchased from central stations. He dealt particularly with the use of process steam to generate power in industrial plants.

Discussing methods of rural electrification, J. B. Johnson of Elyria, Ohio Public Service Company, advocated that central-station companies become more active in selling electrical equipment to farmers and cited the fact that his company in ten months' co-operation with a farm implement dealer had effected the sale of $29,000 worth of such apparatus.

Commenting vigorously upon the necessity of selling additional wiring in old homes, G. E. Miller, sales manager Cleveland Electric Illuminating Company, pictured the difficulties that have been encountered, declaring that basically the cost to the customer is too high.

Progress in electric heat applications was outlined by W. E. Benning, Cleveland Electric Illuminating Company, progress in selling electric ranges by H. H. Davis, Northern Ohio Power & Light Company, and progress in selling domestic electric refrigerators by E. Schmidt, Toledo Edison Company.

At the section dinner a paper by Frank Newton, Commonwealth Power Company, on rates and formation of rate structures, with particular reference to their relation to commercial development, was read by M. W. Arthur in Mr. Newton's absence.

## North Central N.E.L.A. Engineers at Minneapolis

More than two hundred engineers attended the annual conference of the Engineering Section of the North Central Electric Association held at the Nicollet Hotel, Minneapolis, on Jan. 20 and 21. Chairman H. J. Underhill gave an outline of engineering development in the district, and Secretary John W. Lapham outlined the "Developments in the Industry in This Division."

Other addresses on the opening day were: "Relation of Accounting to Engineering," E. G. Kellett, Minneapolis; "Relation of Commercial Activities to Engineering Activities," Carl J. Johnson, Fergus Falls; "Relation of Engineering to Public Relations Activities," T. D. Crocker, Minneapolis; "Lightning and Its Effect on Transmission Lines," J. H. Cox, Westinghouse Electric & Manufacturing Company, and "United States Power Developments," Major H. S. Bennion, New York. Major Bennion spoke at the banquet. Leaders of technical group conferences were William Brown, F. R. Rice, George Loughland, W. J. Sorenson, R. A. Farmer, J. L. McEachin, W. L. Wadsworth and J. A. Colvin. Saturday's program included addresses by E. C. Markley, General Electric Company, on "Carrier-Current Communication Systems," and "Methods of Evaluation of Light and Power Properties for Taxation," by C. H. Nelson of the Minnesota Tax Commission.

# N.E.M.A. Hears About Inter-Industry Struggle

*Director of Institute of Steel Construction Chief Speaker at New York Meeting of Supply Division—Section Conferences All Week*

ONE hundred and twenty-five leading manufacturers in the electrical industry concentrated their attention on merchandising policies on Jan. 24, when the semi-annual meeting of the Supply Division of the National Electrical Manufacturers' Association opened at the Hotel Commodore, New York. The principal speaker, Charles F. Abbott, executive director of the American Institute of Steel Construction, Inc., described what he called "the third industrial revolution," meaning the inter-industry struggle for markets. The capacity of industry to produce faster than the market can consume, coupled with co-operative advertising campaigns which quickly change public taste, offers a problem which industries must meet with the soundest merchandising principles, Mr. Abbott said. Careful market research, selection and training of competent salesmen, co-operative advertising on a scientific basis, selling on service rather than price and organization of industry along co-operative lines were some of the guiding principles offered to the electrical manufacturers by him.

The meeting was opened by D. Hayes Murphy, vice-president of the National Electrical Manufacturers' Association in charge of the Supply Division. Managing Director Waller announced the appointment of W. J. Canada as N.E.M.A. engineer and the coming publication of a book to be called "The National Electrical Code—Its Purpose and Development."

H. T. Bussmann, president Bussmann Manufacturing Company, St. Louis, in describing the activities of the electrical Industry Sales Conference said that little or nothing has been done by the electrical industry up to the present time to give the public a complete picture of the value of electrical service and appliances. Before such a program can be accomplished thirty thousand contractors who are now facing a dwindling market must be educated to better selling and business methods, he said. The contractor must be taught to sell outlets not as outlets but on the basis of the service which such outlets will render. A marketing counselor is now needed, he held, to correlate the reports already made by the electrical industry sales conference and to build up a complete sales story.

S. L. Nicholson told the meeting of the establishment of harmonious relations between the manufacturers and the Underwriters' Laboratories in the past year.

An entertainment was held at the dinner-hour on Tuesday evening, followed by a theater party on Wednesday night. An extensive program of sectional meetings and activities was carried on throughout the week.

## Power Board Proceedings

*Far Western Projects Continue to Provide the Major Part of the Work, but Missouri, Virginia and Texas Are Heard From*

IN ADDITION to the authorization of licenses and permits noted last week (page 165) the Federal Power Commission at its meeting on Jan. 18 sanctioned a license for the Idaho Power Company of Boise covering two constructed projects on public lands on the Snake River. These are the Lower Salmon Falls plant near Gooding, an 8,700-hp. project, and the Swan Falls plant near Boise, a 12,000-hp. plant. They have been in operation for many years. They were built by other companies. Another license authorized was for Harry V. Gates of Hillsboro, Ore., and covers a 352-hp. project on Crooked River, Ore. The Seafoam Mines Corporation of Seafoam, Idaho, obtained a license covering a 240-hp. project on Fleet Creek.

The preliminary permit issued under date of Nov. 6, 1925, to the Oregon-California Hydro-Electric Company for projects on the Zigzag, Salmon and Sandy Rivers in Oregon was extended to Nov. 6, 1928. An extension until Dec. 3 was granted Arthur Moa of Ketchikan, Alaska, applying to his preliminary permit for a power project on Fish Creek in the Tongass National Forest, and an extension of eighteen months from May 26 was authorized for the project of the Red River Lumber Company of Minneapolis on Nat Creek, Shasta County, Calif. Three preliminary permits issued to George B. McClary of Chicago, covering projects on Rock River in Illinois, were canceled.

An application from the Southern Sierras Power Company of Riverside, Calif., for an extension until Dec. 31, 1929, of the construction time allowed on parts one and two of its project on Snow Creek in the Angeles National Forest was granted, as was extension of time for the completion of the project of the Escondido Mutual Water Company at San Luis Bay River, Calif. The commission denied the application of the Great Western Power Company of San Francisco for an amendment to its license covering its power project on the North Fork of the Feather River so as to "include other works incidental to the power project and the reconstruction of county roads and state highways." The time for beginning construction on the project of the Gold Basis Mining & Milling Company on the East Fork of the North Fork of the Yuba River was extended to July 1.

The commission assumed jurisdiction over a project on Eleven-Point River in Oregon County, Mo., where Jess Priest and W. H. Williams had announced their intention to construct a 60-ft. dam which would create a 20,000-acre-ft. reservoir. In connection with the declaration of intention of the Western Washington Electric Light & Power Company the commission also ruled that it should take jurisdiction. The proposed project is at North River near South Bend, Wash., where navigation is possible. It is planned to construct a dam 100 ft. high which will create a reservoir of 210,000 acre-ft. capacity.

The commission did not take jurisdiction over a small New River project of the Fields Manufacturing Company, Mouth of Wilson, Va. New River at that point is not navigable. The commission also declined to take jurisdiction over the project submitted by James C. Kennedy of Dallas covering a proposed development on Devil's River in Val Verde County, Tex., the Chief of Engineers holding that Devil's River is not navigable. It rejected an application for a license by the Sierra & San Francisco Power Company covering a constructed project on the South Fork of the Stanislaus River to include certain proposed extensions of the plan.

W. J. Prewett of Auburn, Calif., has applied for a preliminary permit covering a project on the North and Middle Forks of the American River. He proposes to build a dam 340 ft. high across the North Fork, forming a reservoir with 600,000 acre-ft. capacity, and to install 100,000 hp. This application conflicts with previous applications made by Walter L. Huber and the American River Water & Power Company.

The Virginia Public Service Company of Charlottesville has applied for a license covering a transmission line to connect the western and southern divisions of its properties. The line would traverse the Natural Bridge National Forest.

**Robert R. Severin of Paisley, Ore., has applied for a license covering a small project on the Chewaucan River in Lake County, Ore.**

**The United Mercury Mines Company of Boise, Idaho, has applied for a permit covering a small project on the East Fork of the South Fork of Salmon River near Yellow Pine, Idaho.**

## Public Utility Course for Business Executives

A six weeks' summer course in public utility management and economics for business executives will be given July 9 to Aug. 18 next by the Harvard University Graduate School of Business Administration, Soldiers' Field, Boston, under Philip Cabot, professor of public utility management, and D. W. Malott, instructor in this subject. The course will cover various legal, economic, engineering and financial phases of management and will include a study of court and commission decisions covering valuation, depreciation and fair return, besides cases from company practice in methods of marketing, rate making, operation, finance, customer relations and the broad economic problems of production. Classes will meet for four hours daily, and the case method will be followed throughout.

The course is intended for executives and their assistants, statisticians, sales managers and production superintendents of utilities; members of regulatory commissions, investment bankers and teachers of law and business.

## Ask for Short-Wave Bands

*N.E.L.A. Representatives Request Commission for Exclusive Use of Two Groups at Least, but Preferably of Three, for Power Companies*

THIRTEEN officials of large light and power companies in Massachusetts, New York, New Jersey, Pennsylvania, Maryland, Illinois, Michigan and Georgia joined as representatives of the National Electric Light Association in submitting a statement to the Federal Radio Commission when that body last week at Washington held its hearings on short-wave assignments. Asserting that the electric power supply utilities desire "the exclusive use of only a very limited assignment of wave lengths in the interest of maintaining service and in no way for commercial gains," the N.E.L.A. committee made the following response to five specific questions asked by the commission:

1. The electric power supply utilities require space radio facilities as an emergency means of communication for dispatching purposes. Wire communication, whether it be by lines leased from commercial communication companies, by private telephone or telegraph lines, or by carrier current, or by any combination of these, is the primary means of communication in power company systems. However, the acts of God and other uncontrollable events which put out of service the transmission lines of the electric company also put out of service the wire communication in the same geographical area occupied by these transmission lines. In the interconnected electrical systems of today and tomorrow, as well as in local transmission systems, it is absolutely necessary that continuous communication be maintained between strategic points. Space radio offers the only form of communication which will operate between two given points during intervals when wire facilities are inoperative.

2. The prime importance of continuity of electric light and power supply to the large cities, the innumerable smaller communities and to the farm and factory is a subject not open to question or dispute. Dependent upon constant power supply besides the usual industrial and domestic consumers are water utilities, hospitals, signal systems, train-control systems, fire-alarm systems, traffic signals, street lighting and various other uses which directly affect the safety of public life and property. The disastrous effects of allowing a city or town to remain in total darkness for any length of time can be readily pictured. The electric light and power industry serves almost seventy million people, with the enormous capacity of over 30,000,000 hp. Companies serving 40 per cent of this population have already either adopted space radio for emergency communication or are planning to do so at the earliest possible moment.

3. Experience gained in tests over the past two years indicates that the exclusive use of at least two bands, one in the 133-150-meter (2,250-2,000-kilocycle) group, and the other at the second harmonic of the first, should be reserved for this purpose. A third band at 90 meters (3,340 kilocycles) would also prove of great assistance in this work if it could be made available. The width of these bands should be 160 kilocycles. Each station should be allowed to use any allocated band.

4. The power required by electric utility radio load-dispatching stations will be, in

times of emergency, the maximum output that can be achieved by any given station. Under normal conditions the lowest workable power output will be used. In the light of present-day knowledge 5 kw. is suggested as a maximum. The interference likely to be caused to other services in these bands will not offer any obstacle, as the operating contacts which exist between electric supply companies are such that they will be entirely able to police their own bands. This, of course, presupposes an exclusive assignment to electric supply companies. The interference likely to be caused to other countries should not be appreciable, as power company communication requirements will in general be limited to distances of approximately 100 miles.

5. Based on answers to letters sent to all member companies of the National Electric Light Association, it is estimated that about one thousand applications for licenses for this service will be made within the next five years.

It will be some weeks probably before the commission's decision is handed handed down.

## Plans for Hydro Development on New York Lakes

Further details have been given out concerning the hydro project for upper New York State noted in the ELECTRICAL WORLD for Nov. 5 (page 960). The temporary dam at Bradford, on which work has been begun by the Dutcher Construction Company of Sodus for the Lamoka Power Corporation, is to be the first link in a power chain designed to take advantage of the relative positions of Lakes Waneta and Lamoka and Lake Keuka. Several years will be required to complete the project. According to present plans, water will be diverted into Lake Keuka from a power reservoir several hundred feet above Keuka Landing. It will be carried down through mains into a power house to be erected at the landing.

A dam 20 ft. high and one mile long will be constructed at the opening of the Lamoka Valley, one mile north of Savona. Behind the dam will be stored water in an artificial lake 16 miles long and one mile wide covering hundreds of acres of farm land. The lake will extend to Bradford, on the summit of the Wayne Hills. A system of feeders will be constructed from the Conhocton River near Savona into the reservoir. The power company already owns the water rights of the former Baker Mills between Bath and a point two miles west of Savona. Plans call for construction of a race from the mills through Bath to Savona to take advantage of floodwaters by diverting them into the reservoir.

The levels of Lakes Waneta and Lamoka will be raised from five to six feet. At the village of Wayne, which will be the outlet for the reservoir, sluiceways and conduits will carry the water down Keuka Hill to the power house. The present village of Sonora will disappear. The temporary dam will confine the waters of the two lakes. Its completion will be followed by work on the power house in order that generation may begin as soon as possible. Power, it is expected, will be sold to communities throughout northern New York State.

The Lamoka Power Corporation is capitalized at $9,000,000 and is headed by Ray Mills and Warren Mills of Sodus.

## Tacoma Considering Start on Second Cushman Unit

Less than two years after completion of the first unit of Tacoma's municipal power plant on Lake Cushman, which brings in 50,000 hp. for the city system, officials are taking steps toward the construction of the second unit. This is intended to develop 45,000 hp., and Ira S. Davisson, Commissioner of Light and Water, declares that, according to present indications, it will be needed to avoid a power shortage in the winter of 1930-31. Mr. Davisson asked the consent of the Council to bring in ordinances providing for starting work on the second unit, but the Council asked for more time to study the situation. The proposed ordinance would appropriate $4,000,000. A 13,000-volt transmission line from Unit No. 1 at Cushman to the site of the projected second unit, with a connection to the site of the second dam to be built, is already under way and will serve the farmers' mutual distribution system on Hood Canal.

It will take between two and three years to complete the second unit, Commissioner Davisson states. J. L. Stannard, chief engineer for the first unit, will continue in that capacity on the second.

## Plans for the Augmentation of Seattle Power

The City Council of Seattle is preparing to authorize an expenditure of an additional $5,000,000 in the Skagit hydro-electric development on one of two plans which are now before that body. One, introduced by Councilman Oliver T. Erickson, which has the backing of the majority of the Council, authorizes a contract with the Ambursen Dam Company for plans for a dam at Hanging Rock and paves the way for what has been known as the Hanging Rock program. The other plan, backed by the minority group in the Council and proposed by Councilman W. T. Campbell, calls for immediate construction of a power house at Diablo Canyon. This latter plan has the backing of both City Engineer C. W. Morse and Superintendent of Lighting J. D. Ross, Mr. Ross declaring that the Diablo development can be completed at a cost of $35 a kilowatt, whereas the Hanging Rock development will cost $100 a kilowatt. The Diablo plan provides for immediate installation of a third generator, 50,000 hp., in the present Gorge power house; construction of a complete power plant at Diablo Canyon, where a dam is now in process of construction, this plant to have two complete generating units of 50,000 hp. each; construction of a power tunnel, approximately 1,800 ft. long, extending from the Diablo Dam to the power house, to be built at Reflector Bar, below the Diablo Canyon; building of a transmission line from the Diablo power house to a connection at the Gorge power house with the existing transmission line to Seattle, and construction of a second main transmission line from the Skagit plant to the city of Seattle, a distance of 105 miles.

An award has been made to the Winston Brothers Company of Minneapolis, for construction of the Diablo Dam. The contract price was $2,546,338.

## Kentucky Utilities Men Show Pride in Work

*Hydro-Electric Achievements in State Praised—Problems of Industry Discussed—Former Governor Speaks in Appreciation of Electric Development*

WORK of untold benefit in conserving the natural resources of Kentucky has been done in the construction of power dams on the Dix River and at the Falls of the Ohio River, W. R. Power, president of the Kentucky Association of Public Utilities, said in opening the eleventh annual meeting of the association at the Brown Hotel, Louisville, on Wednesday, Jan. 18. The foresight of the Kentucky Utilities Company, builders of the Dix River dam and plant, and of the Louisville Gas & Electric Company, owners of the Ohio River Falls project, was praised. Another point touched upon by Mr. Power was the fact that engineering and technical matters which for years occupied most of the time of association meetings have become standardized, until the more interesting problems now are in the commercial department or in the development and growth of the industries.

Tom Wallace, chief of the editorial staff of the Louisville *Times*, speaking on rural electrification, urged the utility men to give more aid to the farmers in solving their problems. Dean F. Paul Anderson of the College of Engineering, University of Kentucky, said "no group of men in America have meant more to the remarkable economic progress of the United States in the last few years than the public utility men." Miss Esther Rockey, Dayton, Ohio, chairman of the women's division of the East Central Division, N.E.L.A., reported on the growing number of light and power companies which have organized home service departments. Addison W. Lee, general superintendent of the Louisville Gas & Electric Company, urged public utility managers in the state to do all in their power to eliminate radio interference which originates in their plants or along their lines. Important betterment of public relations can be brought about through the attitude of the companies in this matter, he said. A. B. Sawyer, president Farm Bureau, St. Matthews, Ky., held that development of power on the farm was largely a

question of the ability of the farmer to finance it.

N. H. Dosker, vice-president Louisville National Bank & Trust Company; F. W. Rodenheber, manager Louisville Safety Council; Prof. John B. Troxwell of the University of Louisville, and W. H. Lovejoy, Louisville Water Company, spoke at the closing session on Thursday.

The business sessions drew gatherings of about a hundred, but more than 400 persons attended the annual banquet, visitors including Mayor Harrison of Louisville, state, city, county and federal officials. Ex-Governor Edwin P. Morrow, a member of the Federal Railway Wage Arbitration Board, and Lucius S. Storrs managing director of the American Electric Railway Association, New York, were the speakers.

Mr. Morrow praised the development of natural resources by the electric light and power industry. He expressed a desire that scenic beauties be retained, but urged that electric development in Kentucky be continued, to allow the state to take its rightful place as a great source of power.

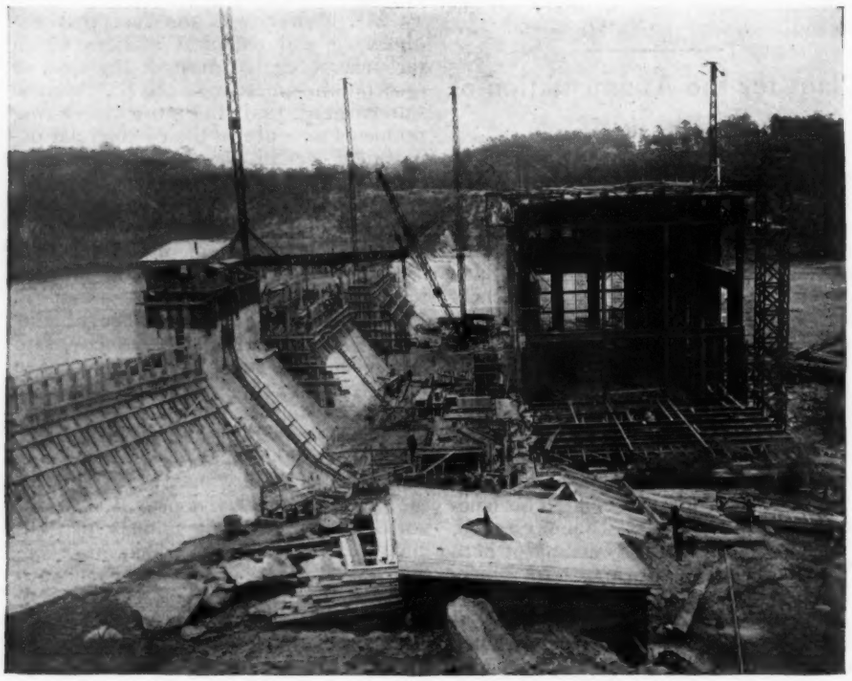
Samuel Riddle, vice-president of the Louisville Railway Company, was elected president of the association. Other officers named are: Vice-presidents, W. H. Harton, general manager of the Cincinnati, Newport & Covington Railway Company, and L. B. Herrington, president of the Kentucky Utilities Company; secretary, E. F. Kelley, Louisville Railway Company, and treasuerer, A. A. Tuttle, Kentucky Utilities Company. Robert Montgomery, general sales manager Louisville Gas & Electric Company, was reappointed chairman of the Kentucky Committee on Public Utility Information.

## Hetch Hetchy Still Fights to Buy Distribution Plants

Final argument in the valuation proceedings instituted four years ago by the city of San Francisco in an effort to acquire for its Hetch Hetchy plants the Pacific Gas & Electric Company's and the Great Western Power Company's distribution systems within the city limits were presented before the State Railroad Commission of California on Jan. 20. Both sides received three months in which to file briefs and 30 days additional for replies. The commission has denied the motion of the two power companies to dismiss the proceedings, and it is expected the power companies will appeal to the courts on the ground of jurisdiction and constitutionality. In consequence a final decision on the valuation of the properties is not expected for many months.

Hetch Hetchy power is now delivered to the Pacific Gas & Electric Company, Newark, on contract. The companies' and the city's figures on the value of the distribution systems are very widely apart.

## Reconstruction of Upper Tallassee Plant in Alabama



THE above illustration shows the status of reconstruction of the Alabama Power Company's Upper Tallassee plant a few weeks ago. At this plant the old 30½-ft. dam is being raised to 56 ft. When complete the power house will contain two 24,000-hp. units. Generation will begin in June, 1928, if the present construction program is adhered to. This plant is on the Tallapoosa River and will have the advantage of the storage capacity afforded by the Martin Dam development completed in 1926. On Dec. 1 about 56 per cent of the concrete had been poured and 95 per cent of the excavation completed.

## Purchases and Mergers

*Baltimore Company May Buy Havre de Grace Competitor—U. G. I. to Acquire Wilmington Properties—Consolidation in the Dakotas—Georgia System for Foshay*

CONTROVERSY over light and power service in Havre de Grace and northern Maryland (see ELECTRICAL WORLD, Jan. 21, page 165) may be solved by the Consolidated Gas, Electric Light & Power Company of Baltimore purchasing the Harford County property of the Northern Maryland Power Company. "Negotiations for the purchase of the Northern Maryland's property are under way," President Wagner of the first-named company is quoted as saying, "but I cannot say when or if the deal will be completed."

The United Gas Improvement Company is to acquire a group of utilities centering in Wilmington, Del., and including the Delaware Electric Power Company and subsidiary electric power and traction corporations controlled by the American Electric Power Corporation. The deal involves the exchange of Iowa properties controlled by the U.G.I. Plans for expansion at Wilmington were outlined on Dec. 17 (page 1263).

Consolidation of the electric and power plants in fifty cities and towns in central and western South Dakota and about fifteen in the southern part of North Dakota with the properties of the Hughes Electric Company of Bismarck, N. D., has been announced by E. A. Hughes, controlling the Hughes Electric Company, and the owners of the Northern Power & Light Company of Mobridge, S. D. The Hughes company's power station at Beulah, N. D., will be tripled in capacity and the power to be furnished over the combined system will be generated there and at Mobridge, Mr. Hughes says. Interconnection of the two distributing systems will be begun at once.

Control of the Baker County Power Company, owning and supplying electric properties in Newton, Camilla and fifteen other Georgia towns, has been purchased by the W. B. Foshay Company of Minneapolis for the Public Utilities Consolidated Corporation of Arizona. The value is said to be in excess of $1,300,000. The main office of the company has been moved from Newton to Camilla.

Sale of a controlling interest in the Kentucky Power Company and the Maysville Public Service Corporation and their subsidiaries to the United Public Service Company of Chicago is announced by Barrett Waters, president of the Kentucky utility companies, who is quoted as placing the value of the companies taken over at more than $4,000,000.

According to local reports, several large power companies in the East and South will file bids for the Kinston (N. C.) electric light plant on or before Feb. 6. There has been, as previously reported, considerable effort to acquire this municipal plant, and bids of $611,000 and $630,000 were refused last year.

# Briefer News

NEW INTERSTATE LINE IN THE CAROLINAS PLANNED BY DUKE POWER.—A high-tension line between Canton, N. C., and Greenville, S. C., is to be built by the Duke Power Company this year, according to a recent announcement. It will connect Greenville with the Pigeon River hydro-electric plant of the Carolina Power & Light Company, 50 miles or so distant.

PUBLIC SERVICE CONFERENCE MEETS IN AUGUSTA.—A public relations conference of the operating companies of the New England Public Service Company took place on Jan. 18 and 19 at Augusta, Me. George S. Williams, vice-president Central Maine Power Company, presided at the opening session, and the chairmen at other sessions were W. A. Buttrick, president Twin State Gas & Electric Company, Boston, and A. R. Schiller, vice-president Public Service Company of New Hampshire. Among the principal speakers were Martin J. Insull, Walter S. Wyman, J. Brodie Smith, J. B. Reynolds, Miss Sophia Malicki and W. S. Vivian.

STEAMSHIP "CALIFORNIA" PUT IN SERVICE. — Following builders' trials, the *California* — asserted to be "the world's largest" electrically driven commercial vessel—has sailed from Newport News, Va., to New York City and starts on its first voyage Jan. 28. She is due to arrive at San Francisco on Feb. 13, which will reduce the existing fifteen-day passage between New York and California by two days. The boat is completely electrified, including propulsion and auxiliaries, General Electric equipment being used. The main power plant consists of two marine-type steam turbines, each rated at 6,750 shaft-horsepower with a maximum capacity of 8,500 shaft-horsepower. Each turbine is directly connected to an alternating-current generator rated at 5,250 kw. and having a maximum continuous rating of 6,600 kw. There are two main propulsion motors, one directly connected to each propeller shaft, and each being of the synchronous induction type, rated at 5,250 kw.

A "BOULDER DAM" PROPOSED FOR NEBRASKA. — Representative Shallenberger of Nebraska has introduced a bill at Washington to appropriate $20,000,000 to develop the combination irrigation and power plant on the Platte River in Gosper County which the State Legislature, at its last session, refused to authorize with the state as a guarantor of the bonds. He plans to tie it up with other river appropriations and schemes. The cost would be amortized over a period of fifty years and recouped out of the profits from the sale of water for irrigation and power. The bill follows the Boulder Dam proposal in its general lines, but also proposes that the profit from the sale of power shall be perpetually used to maintain the plant and repay the cost. Senator Howell of Nebraska has promised to support the project, but the plan has not met with favor in engineering circles because of the distance of the state's principal markets for electrical energy.

BILL FOR SOUTH CAROLINA STATE HYDRO SYSTEM UNFAVORABLY REPORTED.—A bill introduced into the South Carolina Legislature which would sanction the development of water power by the state under a commission of five members, whose duties would include many other matters, including the duty "to pay the costs of government," has been unfavorably reported.

LINE EXTENSIONS IN NEBRASKA.—The Iowa-Nebraska Light & Power Company has been authorized by the Nebraska Railway Commission to make several extensions in southeastern Nebraska; the Interstate Power will build a line from south of Spencer, connecting the plant on the Niobrara River directly with the towns of Bristow and Lynch; the Central States is to connect Macy with its Walthill plant; the Nebraska Power is building a line from Valley to Le Shara and Yutan and extending its line at Meadows, while the Nebraska Electric is connecting its plants at McCook, Gothenburg and Lexington so that sufficient standby service will be available in emergencies. To add to its generating capacity at Lexington the last-named company is installing a large internal-combustion engine and a direct-connected generator.

## *Coming Meetings*

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see ELECTRICAL WORLD for Jan. 7, page 80.]

Iowa Section, N.E.L.A.—Roosevelt Hotel, Cedar Rapids, Feb. 2 and 3. H. E. Weeks, Davenport, Iowa.

American Institute of Electrical Engineers — Winter convention, New York, Feb. 13-16; St. Louis regional meeting, March 7-9. F. L. Hutchinson, 33 West 39th St., New York.

Rocky Mountain Division, N.E.L.A.—Albuquerque, N. M., Feb. 14-16. O. A. Weller, 900 15th St., Denver.

Midwest Power Conference — Hotel Stevens, Chicago, Feb. 14-17. G. E. Pfisterer, 53 West Jackson Blvd., Chicago.

Iowa Power Conference—University of Iowa, Iowa City, Feb. 15 and 16. Joe Carmichael, Iowa Committee on Public Utility Information, 310 Crocker Bldg., Des Moines.

Northwest Electric Light and Power Association — Commercial Section, Portland, Ore., Feb. 20 and 21; Engineering Section, Spokane, Wash., March 8 and 9. Berkeley Snow, 1208 Spalding Building, Portland, Ore.

New Mexico Utilities Association—Albuquerque, N. M., Feb. 20-22. Arthur Prager, Albuquerque Gas & Electric Company, Albuquerque.

Oklahoma Utilities Association—Tulsa, March 13-15. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association—Hotel Abraham Lincoln, March 14-15. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

National Electrical Manufacturers' Association—Policies Division, Edgewater Beach Hotel, Chicago, March 14-16. S. N. Clarkson, 420 Lexington Ave., New York.

CARRYING NEW LINE OVER THE SUSQUEHANNA AT HARRISBURG.—Another high-tension river crossing is progressing rapidly at Harrisburg, Pa., where the Harrisburg Light & Power Company is building a 66,000-volt line across the Susquehanna River to New Cumberland. This line is to extend from the company's plant in the southern end of Harrisburg west to Mechanicsburg and possibly to Boiling Springs. The largest of the three steel towers is being erected on an island in the river. It will be 320 ft. high and 60 ft. square at the base. The tower on the eastern side of the river will be 120 ft. high and that at the southern end of New Cumberland will be 155 ft. high. They will carry eight cables.

INTERSTATE POWER 9.06 PER CENT OF ALL GENERATED BY ELECTRIC LIGHT COMPANIES.—The Bureau of Business Research of Harvard University has just published a study entitled "Interstate Transmission of Electric Light and Power Companies in 1926" and based on a nation-wide survey. The total quantity of electricity transmitted across state lines, as reported to the bureau, aggregated 6,171,530,837 kw.-hr. in 1926, exclusive of power crossing the Canadian or Mexican boundaries. This is approximately 9.06 per cent of the total generated by all electric light and power companies in the country. Of all interstate power 26.28 per cent involved no change in ownership, according to the bureau's report. In 1926 there were in operation 453 interstate power lines. Of these 152, or 33.6 per cent, were placed in operation in the years 1924, 1925 and 1926.

PUGET SOUND POWER & LIGHT HAS FIVE-MILLION-DOLLAR BUDGET.—The Puget Sound Power & Light Company, Seattle, through its vice-president, W. H. McGrath, announces that $5,000,000 will be spent in 1928 for construction and extensions. Included in this amount is an item of $1,267,000 covering cost of a new unit at the Baker River power plant, together with the necessary addition to the power house. The sum of $787,000 is provided for a transmission line from the Baker River plant to the Beverly Park station; line extensions for new customers will cost $1,652,000, and increasing the capacity of old substations and building new ones represent a proposed investment of $618,400. At least ten thousand families will be served with electricity who have not before had this convenience. Seventy-two hundred rural customers were added in 1927.

HYDRO PROJECT FOR GENESEE RIVER AT LETCHWORTH PARK IN NEW YORK.—In its first annual report, just issued, the Division of Water Power and Control of New York State reports two applications for approval of water-power projects as received last year. One was from the M. B. Light & Power Company (now owned by the Associated Gas & Electric

Company) for surplus canal waters at Eaton, and negotiations for a license are still in progress. The other application came from the Commonwealth Power Company for a project on the Genesee River near Portage. The company contemplated constructing a high concrete dam across the river, creating a lake 17 miles long, and installing capacity totaling 140,000 hp. at the lowest of the three falls in Letchworth Park. The Letchworth Park Commission now has the merits of the plan under consideration.

INTERSTATE QUESTION INVOLVED IN RAISING BELLOWS FALLS DAM.—When the Bellows Falls (Vt.) Canal Company made application recently to the Vermont Public Service Commission for permission to condemn land as a preliminary to raising its dam in the Connecticut River 11 ft., it was disclosed that under an agreement between the canal company and the New Hampshire Public Service Commission the former would be bound to deliver to New Hampshire as much of the additional electricity generated through raising the dam as the New Hampshire commission might order, or even the total amount. On this account the Vermont commission would not sanction the condemnation proceedings. Three courses are left open to the company: It can seek a modification of the New Hampshire agreement, it can buy the land by bargain with the owners, or it can abandon the scheme.

ROGUE RIVER PLANT OF CALIFORNIA-OREGON STARTS UP ONE YEAR AFTER CONSTRUCTION BEGAN. — The first 16,000-kw. unit of the 48,000-kw. Prospect No. 2 development of the California-Oregon Power Company, under construction on the North Fork of the Rogue River, Oregon, was placed in service on Jan. 11, and trial runs on the second unit, which is of the same rating, were started on Jan. 18. Actual work of construction began on Jan. 24, 1927, and work during the first few months was carried on under the most adverse conditions, heavy snows being followed by a prolonged rainy season. The third unit will be installed when the need for additional power becomes apparent. Prospect No. 2 is tied in with Prospect No. 1 station, which is served by the same canal. The new plant called for the construction of 70 miles of 132-kv. line and 6 miles of 66-kv. line between Prospect and Medford, Ore.

BACKUS EXPOUNDS HIS INTERNATIONAL HYDRO PLANS.—The first authorized statement made public in regard to the proposal now before the International Joint Commission for a construction of a series of storage dams in the Lake of the Woods district, which lies just on or above the boundary line between Minnesota and western Canada, has just been issued by E. W. Backus of Minneapolis. The Backus-Brooks company has proposed the construction of reservoir dams at Basswood, Saganaga and Crooked Lakes and at Lac La Croix. The company also proposes to increase the height of the dam already built at Rainy Lake, which would provide storage for a total of 120,000,000,000 cu.ft. of water above the present Rainy Lake and Namakan chain of lakes. The statement declares that about 100,000 additional hydro-electric horsepower can be developed in the area, of which 50,000 hp. can be used in Minnesota. Mr. Backus and his associates are waiting for the final reports of the engineers of the International Joint Commission before they can determine to what extent, if any, their plans should be modified. They will then be prepared to urge their case before the commission.

## Commission Rulings

JUSTIFICATION OF METER DEPOSITS IS DUTY OF UTILITY.—The burden of justifying a meter deposit was said by the North Dakota Board of Railroad Commissioners to be upon the utility company proposing such a charge where a protest against it was made, and the fact that a meter deposit was in effect in numerous places in the state was not conclusive as to its necessity or reasonableness in all cases. The rules of the commission provided that a utility might require from all consumers or prospective consumers, subject to approval of the commission, a cash deposit, but the commission ruled that it was not therefore mandatory upon a utility to require a meter deposit in every instance. The fact that the majority, if not all, of the consumers of a company owned their meters was said to raise a question in the minds of the commission as to the propriety of the charge. Furthermore, in the case under review, which affected the Hughes Electric Company, the record was conspicuously silent as to the reasonableness of the charge proposed.

CAPITALIZATION OF EXCESS PRICE PAID FOR PROPERTY REFUSED. — The Illinois Power & Light Company asked the Illinois Commerce Commission for permission to buy the Maroa Electric Light Company for $60,000. The commission valued it at only $35,000, but authorized the sale with the proviso that the price paid should not be taken as a basis for rate making. It was required further that the sum in excess of what the commission deemed to be reasonable value should be charged neither to operating expenses nor to capital account, but should be amortized or wiped out at the expense of the stockholders. The commission said: "Under the present method of financing, most public utilities have a wide distribution of securities among consumers, and the imposition of conservative capitalization performs a two-fold service to those ultimately affected," implying that excessive stock issues may indirectly affect consumers by impairing the company's credit, while as stockholders they would, of course, be directly affected. The commission aimed, therefore, at protecting the interests both of rate payers and of future stockholders.

## Recent Court Decisions

BURDEN RESTS ON THOSE SEEKING SPECIAL RATES TO SHOW THAT THOSE SET BY COMMISSION ARE UNJUST.—The Supreme Court of Oklahoma has sustained the Corporation Commission of that state in refusing to make special rates for natural gas applicable to a zone comprising the city of Tulsa (Tulsa Tribune Company vs. Oklahoma Natural Gas Company). The court found the presumption to be that the commission's refusal was just and reasonable and held that the appellant had failed in its endeavor to demonstrate the contrary. (261 Pac. 213.)*

DUTIES OF UTILITY SERVING PATRONS AT SUMMER RESORT.—Although a utility company serving a summer resort has the right to enforce reasonable regulations and decline to furnish service unless these are observed, light and water service may not be cut off to enforce a disputed claim or a collateral liability. For this reason the owner of the utility serving Macatawa Park, Mich., was rightly found culpable in discontinuing service to a patron merely because he refused to install a septic tank, and an award of $1,000 damages to the customer, whom the action of the company prevented from renting cottages owned by him, was not excessive. So found the Supreme Court of Michigan in Ten Broek vs. Miller. (216 N.W. 385.)

INDUCTIVE INTERFERENCE BY POWER COMPANY'S LINES WITH MACHINE TRANSMISSION OF MESSAGES BY TELEGRAPH COMPANY NOT A NUISANCE.—The Postal Telegraph-Cable Company brought suit for damages against the Pacific Gas & Electric Company on the ground that "there extends in all directions" about the latter company's 53,000-volt transmission line from Sacramento to Suisun "a field of force for more than 210 ft., and said field of force carries within such field many electric currents of high and varying intensity which are not controlled by or confined to said power lines" and are "inducted onto plaintiff's lines, thereby interfering with the transmission of telegraphic messages thereover," and that "the physical damage to plaintiff's said line and the equipment thereof from such surges and induction within three years last past has amounted to the sum of $2,000." This, the plaintiff contended, constituted a nuisance in the statutory sense, but the Supreme Court of California, sitting *en banc*, has sustained the lower court in finding to the contrary and denying the right of action for damages. The interference alleged was specifically with machine transmission, and the power company made the point that this was an extraordinary use of the plaintiff's property and therefore not subject to the same considerations as inhere in ordinary use. The plaintiff's further charges against the power company of negligent construction and failure to keep lines in repair were dismissed by the court as too general and insufficient to be sustained against demurrer. Five judges concurred in this part of the decision, but two of the five dissented from the first part, holding that a nuisance had been shown to exist. (260 Pac. 1101.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

HOWARD BARDWELL, assistant to the general superintendent of the Empire District Electric Company in the production department, has been appointed head of a newly created division dealing with compensation insurance, employees' safety and personnel problems. In connection with the appointment he has been relieved of his duties in the production department. Mr. Bardwell has for the past three years handled most of the problems arising from employees' compensation and safety and personnel work. The volume of this work has grown to such an extent that it is felt that he can profitably give his entire time to it. Mr. Bardwell has been with the organization nine years. He joined the results department at the Riverton plant early in 1919, but was transferred to the Joplin office in 1922.

H. C. BLACKWELL, president of the Union Gas & Electric Company, Cincinnati, has been elected president of the Cincinnati Chamber of Commerce. Mr. Blackwell served for several years as chairman of the industrial committee of the chamber. He has been in Cincinnati since 1924, when he transferred his interests from Kansas City (Mo.), where he had been vice-president and general manager of the Kansas City Power & Light Company.

EDWARD M. GRAHAM, Bangor, Me., president of the Bangor Hydro-Electric Company, has been elected president of the Eastern Manufacturing Company, which operates mills at Lincoln and South Brewer, Me., in the manufacture of sulphite pulp, writing paper and rayon cellulose, to succeed Stewart Webb of Boston, Mass.

THEODORE DIENST, for the past several years superintendent of the Kansas Electric Power Company at Parsons, has been appointed manager of the McAlester division of the Southwest Power Company to succeed H. T. Asbury, who has assumed new duties in Arkansas.

E. T. HUGHES, for eight years manager of the Yankton (S.D.) division of the Northwestern Public Service Company, has been appointed superintendent of the Kansas Electric Power Company at Parsons to succeed Theodore Dienst, who has assumed new duties in Oklahoma.

GLENN C. KILEY, formerly service manager of the Oklahoma Gas & Electric Company, Oklahoma City, has been appointed local manager of the company in that city and in that capacity will supervise local matters in Bethany, Moore, Britton, Choctaw, Harrah, Jones and Yukon as well as in Oklahoma City. Mr. Kiley entered the employ of the Byllesby Company in Chicago in the rate and valuation department in 1917, removing to Oklahoma in the summer of 1923. He started with the Oklahoma Gas & Electric Company as a traveling auditor and three years ago was appointed service manager, the position he occupied until his recent assignment to the local managership.

## F. H. Woodward Leaves San Francisco

F. H. Woodward, since 1922 general sales manager of the Great Western Power Company, with headquarters in San Francisco, has been transferred to Oakland as manager of that division of the company. The position of general sales manager in the San Francisco office has been abolished. He is succeeding G. W. Bernhard, who has been made industrial heating engineer with

F. H. WOODWARD

headquarters in San Francisco. Mr. Woodward is returning to a territory by no means unfamiliar to him, he having served as manager of the Oakland division from 1912 to 1922. He has been connected with the company for the past eighteen years, having entered its employ in 1909 in charge of industrial power sales.

HAROLD T. MELHUISH has joined the staff of the National Electrical Manufacturers Association as director of the radio division. Mr. Melhuish was formerly connected with the Radio Corporation of America for five and a half years, serving successively as special field representative, district sales manager, assistant general sales manager and manager of sales administration.

J. V. GONGWER has been named chief assistant engineer for the proposed construction of the second unit of the Cushman power project by the city of Tacoma. Mr. Gongwer will occupy the position of superintendent of hydraulic design and construction.

JAMES F. SMALL has been appointed merchandise sales manager of the Public Service Company of Northern Illinois. Mr. Small was formerly manager of the Chicago Heights Gas Company, now a part of the Public Service company. He first entered the utility business with the Peoples Gas, Light & Coke Company and later affiliated himself with the Western United Gas & Electric Company as district manager. After considerable experience as a consulting and operating engineer, he became manager of the Chicago Heights Gas Company in 1917 and held that position until 1926, when that organization became a part of the Public Service company's system.

HERMAN RUSSELL, vice-president of the Rochester Gas & Electric Corporation, has been elected president of the Rochester Chamber of Commerce. In addition to his executive position with the Rochester Gas & Electric Corporation, Mr. Russell is an officer and director in numerous Rochester banks and other organizations and has always given liberally of his time and energy in the interest of the public welfare.

E. J. JONES, for the past fifteen years manager of the Florida Power Company, Ocala, Fla., and its successor, the Florida Power Corporation, has been appointed general manager of the Compañia Electrica de Santo Domingo. This company operates the electrical utilities in the cities of Santo Domingo, Macoris and other cities in the Dominican Republic.

H. P. JONES has been appointed superintendent of meters of the Oklahoma Gas & Electric Company and C. E. BATHE has been named superintendent of electrical standards and radio. W. K. DANVERS has been made superintendent in charge of the maintenance and reclamation department recently established.

DR. THOMAS S. BAKER, president of the Carnegie Institute of Technology, Pittsburgh, is planning to spend six weeks in Europe during February, March and April, to organize plans for the second international conference on bituminous coal at Pittsburgh.

CARROLL A. DEAN has been appointed merchandising manager of the Lawrence (Mass.) Gas & Electric Company. Mr. Dean was formerly in charge of electric appliance sales for the Lowell Electric Light Corporation, Connecticut Light & Power Company and Cambridge Electric Light Company.

R. J. MALCOMSON, formerly street lighting engineer of the Public Service Company of Northern Illinois, in charge of municipal street-lighting sales, has been appointed manager of lighting sales. He is now responsible for both

the general and municipal lighting sales of the company. Mr. Malcomson became associated with the company in 1923 in the capacity of sales engineer and in 1924 was appointed street lighting engineer, which position he held until his present assignment.

LEON O. WHITSELL has been elected president of the California Railroad Commission to succeed Ezra W. Decoto, retired. President Whitsell has been a member of the railroad commission since 1925 and was reappointed for a full term of six years by former Governor Friend W. Richardson, Jan. 1, 1927. He was appointed from Orange county, where he was a member of the board of supervisors, and a leading figure in the citrus industry of that county. He was a practicing attorney for many years before engaging in citrus growing in southern California.

L. S. SMALL has resigned as superintendent of distribution for the Pine Bluff district of the Arkansas Power & Light Company, with which company he had been connected for three years. R. J. RHINEHART, who has been affiliated with the company for about a year, has been appointed to succeed Mr. Small. Mr. Rhinehart was formerly superintendent of service for the Southwestern Gas & Electric Company at Texarkana.

GEORGE E. HARDY, president of the Commonwealth Power Corporation, sailed for Bermuda Jan. 25 for a short vacation.

C. D. PORTER, vice-president and general manager of the Virginia Public Service Company, successor to the Newport News & Hampton Railway, Gas & Electric Company, has resigned to become vice-president and general manager of the Omaha & Council Bluffs Street Railway Company, Omaha, Neb. Mr. Porter has been vice-president and general manager of the Newport News utility since 1921.

C. S. VAN DYKE has been appointed rate engineer for the New York Power & Light Corporation in charge of all matters pertaining to rates, both gas and electric, including the compilation and tabulation of rate information, maintenance of records and the study of new rates. Mr. Van Dyke's headquarters will be in Albany.

B. L. DELACK, assistant manager of the Schenectady works of the General Electric Company for the past year, has been appointed manager of that plant. Mr. Delack has been associated with the company since 1903 and just prior to his connection at Schenectady he was affiliated with the Erie works.

SAMUEL INSULL, president of the Commonwealth Edison Company, Chicago, has been elected president of the Western United Gas & Electric Company, recently acquired by the Insull interests.

E. A. WAGNER has been appointed manager of the Pittsfield (Mass.) plant of the General Electric Company.

THOMAS H. BLODGETT, president and chairman of the board of directors of the American Chicle Company, has been elected a director of the American Water Works & Electric Company and its subsidiary, the West Penn Electric Company.

J. B. ARCHER, district manager of the Iowa-Nebraska Light & Power Company at Shenandoah, Ia., has been transferred to the general office at Lincoln. C. C. Helmers of Lincoln will be located at Shenandoah temporarily as manager.

T. H. HOGG, chief hydraulic engineer of the Hydro-Electric Power Commission of Ontario, was recently made the recipient of the honorary degree of doctor of engineering by the University of Toronto.

J. F. OWENS, vice-president and general manager of the Oklahoma Gas & Electric Company, has been elected first vice-president of the Oklahoma State Chamber of Commerce.

E. A. FELDTKELLER, who for several months has been supervisor for the General Engineering & Management Corporation in the Florida sector, has been promoted to the general managership of the Jersey Central Power & Light Company, southern division, and has taken up his duties at the division headquarters in the company's offices at Asbury Park, N. J.

PAUL FASOLI, formerly superintendent of the Associated Gas & Electric interests at Granville, N. Y., has assumed the duties of general superintendent of the Harlem Valley division, succeeding L. A. Reinhardt, who has been transferred to Ithaca.

J. H. VAN AERNAM has been appointed manager of merchandise sales for the New York Power & Light Corporation with headquarters in Albany. Mr. Van Aernam will supervise all activities in connection with merchandising operations.

C. E. LYON has been appointed superintendent of hydro stations for the New York Power & Light Corporation and will have charge of all hydro stations belonging to the corporation.

C. C. YEAKLEY has been appointed superintendent of the Oklahoma City district, western division, of the Oklahoma Gas & Electric Company.

## Obituary

WILLIAM E. GILMORE, for many years general manager of the Thomas A. Edison industries and in more recent years president of the Essex Press, a publishing house of New Jersey, died Jan. 17 at St. Mary's Hospital, Orange. A native of New York, Mr. Gilmore became identified with the Edison Electric Light Company at the age of eighteen. While with Mr. Edison, in addition to holding the position of general manager, he became president and general manager of the National Phonograph Company. Prior to his association with Mr. Edison directly, Mr. Gilmore in 1886 removed to Schenectady to become assistant secretary of the Edison Machine Works, which subsequently became part of the Edison General Electric Company, the forerunner of the General Electric Company. He was appointed assistant general manager of the Edison General Electric Company and in 1894 Mr. Edison called him to West Orange.

CHARLES S. NORTHCUTT, manager of the San Joaquin division of the Pacific Gas & Electric Company, died Dec. 17 of injuries received in an automobile accident. Though a native of Georgia, Mr. Northcutt had been a resident of California since 1905. For four years he engaged in construction work and then became identified with the executive offices of the Sierra & San Francisco Power Company. In 1910 he was appointed agent in Modesto and one year later manager of that district. When, early in 1920, the Sierra & San Francisco Power Company was leased by the Pacific Gas & Electric Company. Mr. Northcutt was appointed manager of the Stanislaus district. Six years ago he was promoted to the position of manager of the San Joaquin division, comprising the Stanislaus, San Joaquin, Tuolumne and Electra districts.

RICHARD J. DIBOWSKI, secretary and director of the Wadsworth Electrical Appliance Manufacturing Company of Covington, Ky., died suddenly Jan. 8 at his home in that city. Mr. Dibowski was one of the founders of the Wadsworth organization and during the period of its growth contributed substantially to its progress. His interest in civic and business affairs led to his appointment as a director of the Associated Industries of Kentucky. Mr. Dibowski was 53 years of age.

ALLEN H. MOORE, who retired six months ago as chairman of the standardizing committee of the General Electric Company on account of ill health, died Jan. 10 at his home in Albany, N. Y., in his 62d year. At the time Mr. Moore relinquished his duties he had to his credit 39 years of service with the General Electric Company and its associated foreign manufacturing companies.

AUGUSTUS T. HOLBROOK, electrical engineer, died in New York, Jan. 12. Mr. Holbrook was for several years identified with the electrical industry in New England, later having removed to New York. He was a member of the American Institute of Electrical Engineers.

# Financial and Statistical News

### *Rediscount Rate Change Markets Again Active Common Stocks Move Up*

SPECULATION with regard to the possible effect upon the security markets of the rise to 4 per cent of the Chicago rediscount rate soon had its answer in a corresponding tightening of money in the New York market. Stocks reacted from two to five points, but utility stocks were the only main group not materially affected. Prices were maintained with negligible losses.

While the Federal Reserve rediscount rate charge in Chicago need not have any immediate effect on the New York money market, the present situation implies a policy rather than an isolated rate adjustment in one locality. There is the imminent possibility of a rise in the other reserve districts and in any event, the board has a rather forceful, if indirect, check upon speculative activities in the rediscount rate.

After last week's hesitation and temporary selling movement in the markets at large, the trend of power and light stocks is again upward, in utter disregard, apparently, of the Walsh Resolution. American Gas & Electric is up to 124; Brooklyn Edison is up 13 points during the week, to 226; Middle West Utilities gained 5 points to 134. Several other common stocks including Public Service of New Jersey, Southeastern Power & Light, Philadelphia Electric, etc., made smaller gains.

## New German Loan Offered

The twenty-million-dollar loan of the Westphalia United Electric Power Corporation, which last week's issue of ELECTRICAL WORLD announced would be offered in the near future, was brought out Monday in the form of first mortgage 6 per cent sinking fund gold bonds, series A. These securities, due Jan. 1, 1953, were priced at 92¾ and accrued interest, to yield about 6.60 per cent. Proceeds will be applied to the payment of bonds and of floating debt incurred for capital expenditures and for additions and improvements to the properties of the corporation and its subsidiary companies.

## Standard Gas Customer Sales Total $32,000,000

Customer-ownership sales of preferred shares of the subsidiary and affiliated public utilities of the Standard Gas & Electric Company established a new high record in 1927, when sales (par value) totaled $31,975,600, an increase of 27.58 per cent over the previous high record in 1926. There were 42,267 separate transactions. The total represents all sales, less only cancellations. Of this amount, repurchases totaled 13.24 per cent, leaving a total of net sales from treasury of $28,236,900. It is estimated that approximately 22,000 new shareholders were added to the subsidiary and affiliated companies through the operation of the customer-ownership plan in 1927. A total of 9,200 customer shareholders must be deducted because of the merger of the Western States Gas & Electric Company and the Coast Valleys Gas & Electric Company with the Pacific Gas & Electric Company. Therefore, the net gain amounted to 12,800 shareholders.

# November Operations Swing Upward

### Electric Light and Power Revenue, $158,000,000—Is 6.5 per Cent Above Last Year—Energy Generated Increases 7.2 per Cent —Both Show Gain Over October

WITH a revenue of $158,000,000, estimated for the entire industry on the basis of reports received by the ELECTRICAL WORLD, and an energy output of 6,503,442,000 kw.-hr., corresponding to a daily average of 217,000,000 kw.-hr., the electric light and power companies in the United States reached the highest figure ever attained as to the latter item and earned the highest monthly revenue with one exception. The earnings were 6.5 per cent above those of November, 1926, and 4.8 per cent higher than in October, 1927. With two months still to go they missed the midwinter peak attained in January, 1927, by less than 3 per cent.

These returns seem to indicate the setting in of an upward movement, though one not yet strongly defined. For the first half of 1927 the revenue exceeded that for the corresponding portion of 1926 by 10.5 per cent. This fell to 7.2 per cent in July, rose slightly in August to 7.3 and in September to nearly 9 per cent, then in October fell to 6.3 per cent. The November earnings thus represent a slight acceleration compared with October business.

Had the growth in revenue continued at the same rapid rate as during the five years from 1922 to 1926 the average daily revenue would have been $5,370,000. The actual revenue, therefore, fell

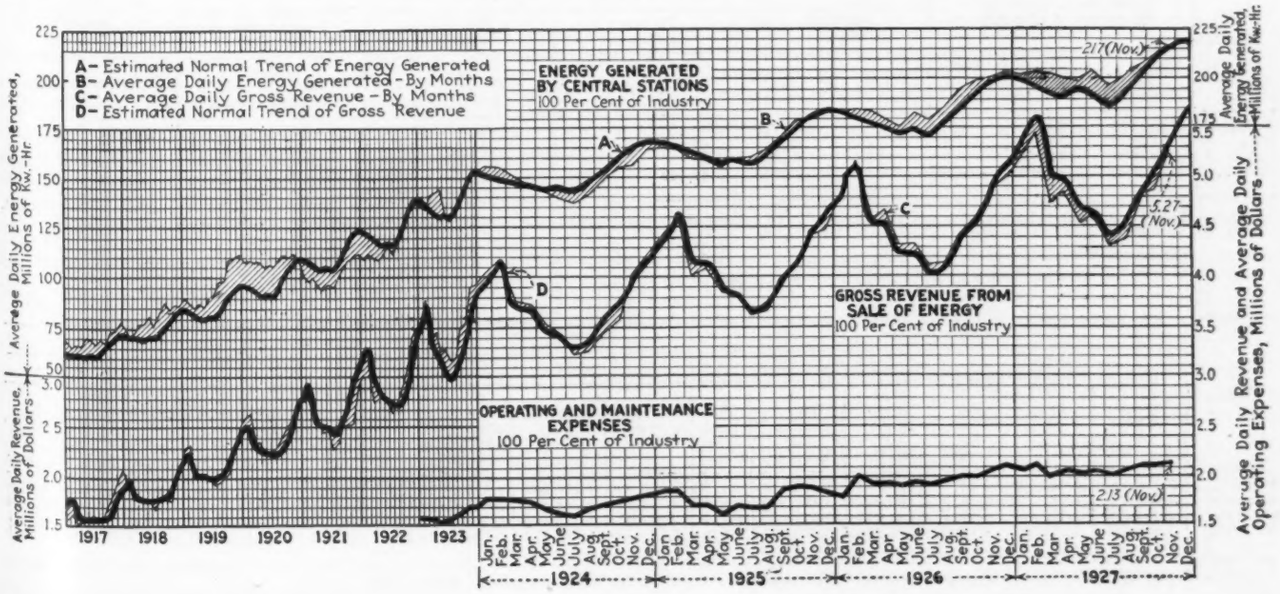

A– Estimated Normal Trend of Energy Generated
B– Average Daily Energy Generated – By Months
C– Average Daily Gross Revenue – By Months
D– Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
217 (Nov.)
5.27 (Nov.)
2.13 (Nov.)
Average Daily Energy Generated, Millions of Kw.-Hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
1917 1918 1919 1920 1921 1922 1923
1924 1925 1926 1927

TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 Per Cent of the Industry)

| Month | Kw.-Hr. Generated Monthly * | | | Estimated Distribution of Energy Generated | | | | | | | | | | Energy Purchased by Public Utilities for Resale, Kw.-Hr. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total Energy Consumption by Central-Station Customers, Kw.-Hr. | | Energy Consumed for Lighting, Kw.-Hr. | | Energy Consumed for Power, Kw.-Hr. | | Energy Sold to Electric Railways, Kw.-Hr. | | Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr. | | | |
| | 1927 Thousands | 1926 Thousands | Per Cent Inc. | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands |
| Aug... | 6,335,335 | 5,777,753 | +9.6 | 5,217,335 | 4,663,753 | 1,265,000 | 1,212,000 | 3,425,335 | 2,932,753 | 527,000 | 519,000 | 1,118,000 | 1,114,000 | 1,290,000 | 1,122,000 |
| Sept... | 6,268,814 | 5,825,852 | +7.6 | 5,158,814 | 4,701,852 | 1,274,000 | 1,188,000 | 3,373,814 | 3,009,852 | 511,000 | 504,000 | 1,110,000 | 1,124,000 | 1,299,000 | 1,225,000 |
| Oct... | 6,576,625 | 6,174,959 | +6.5 | 5,412,625 | 4,981,959 | 1,372,000 | 1,262,000 | 3,484,625 | 3,171,959 | 556,000 | 548,000 | 1,164,000 | 1,193,000 | 1,290,000 | 1,240,000 |
| Nov... | 6,503,442 | 6,063,784 | +7.2 | 5,351,442 | 4,989,784 | 1,400,000 | 1,310,000 | 3,392,442 | 3,128,784 | 559,000 | 551,000 | 1,152,000 | 1,074,000 | 1,269,000 | 1,200,000 |

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only

short of the normal, computed on that severe basis, by only 2 per cent.

Operating expenses increased less than revenue; the net earnings, therefore, make a more favorable showing than the gross; compared with the corresponding months of 1926 they were greater by 9.5 per cent in October and 9.6 per cent in November.

The gain in energy output, as in revenue, was greater than in October, rising to 7.2 per cent above the output in November, 1926. More of the increase was borne by water power than by steam. The former grew by 12 per cent, while fuel-generated energy was only 4.5 per cent greater than a year before. Water power produced 2,456,835,000 kw.-hr., or 38 per cent of the whole.

Although the proportions of coal, oil and natural gas consumed differed slightly, the aggregate in terms of equivalent tons of coal was almost identical in November, 1926, and the same month in 1927. The increase in output was thus achieved without an increase in fuel consumption.

Energy purchased for resale has varied only a few per cent since August and was only 6 per cent greater in November than it was a year earlier.

TABLE II—OPERATING RATIO OF CENTRAL-STATION COMPANIES

| Month | Operating Ratio | | | | | |
|---|---|---|---|---|---|---|
| | Steam Plants | | Hydro Plants | | Combined Hydro and Steam Plants | |
| | 1927 | 1926 | 1927 | 1926 | 1927 | 1926 |
| Aug.. | 52.8 | 53.6 | 34.6 | 36.3 | 44.1 | 45.8 |
| Sept.. | 48.8 | 49.7 | 33.4 | 37.5 | 42.1 | 43.3 |
| Oct.. | 46.9 | 48.3 | 31.8 | 32.4 | 42.6 | 43.9 |
| Nov.. | 44.7 | 45.8 | | | | |

## Pacific Power and Light Announces Refinancing

The incorporation of a new Pacific Power & Light Company to include not only the old company but seven smaller companies, as announced in the Jan. 21 issue of ELECTRICAL WORLD, will necessitate the retirement of $9,119,000 of the old company's 5 per cent, first and refunding mortgage bonds, due April 1, 1930, which will be accomplished by call on an interest date at the call price of 102. A new issue of first mortgage bonds of the new company, in the amount of $17,000,000, will then be sold. Details have not been determined, but a coupon rate of 5 per cent or less, with a long term, is expected.

The outstanding 57,934 shares of 7 per cent, $100 par, cumulative preferred stock of the present company will be exchanged share for share with an identical stock of the new company, and in addition there will be issued 12,216 shares of $6, no-par, cumulative preferred stock for sale to the public as and when needed by the company. Both of these stocks will carry first preferred privileges as compared with the other junior securities of the company. Behind these issues will be 40,000 shares of $6, no-par, second preferred stock and an undetermined quantity of no-par common stock, which will be taken by the American Power & Light Company as reimbursement for advances made by it to the Pacific company and in payment of properties now owned by it but turned over to the new Pacific company. The absorption of the new properties will add about $15,000,000 of physical assets to the company, bringing the total assets up to about $40,000,000.

TABLE III—CENTRAL-STATION FINANCIAL OPERATIONS FOR FOUR MONTHS IN THE UNITED STATES
(100 Per Cent of the Industry)

| Month | Total Gross Revenue from Sale of Energy† | | | Estimated Distribution of Gross Revenue | | | | | | | | Total Operating and Maintenance Expenses‡ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lighting Customers | | Power Customers | | Electric Railways | | Other Public Utilities | | | |
| | 1927 Thousands | 1926 Thousands | Per Cent Inc. | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands |
| August.. | $155,600 | $126,400 | +7.3 | $79,900 | $77,900 | $41,400 | $35,900 | $4,400 | $4,300 | $9,900 | $8,300 | $63,000 | $60,200 |
| Sept.... | 144,400 | 132,600 | +8.9 | 84,200 | 80,500 | 44,400 | 38,000 | 4,600 | 4,500 | 11,200 | 9,600 | 63,600 | 60,300 |
| Oct..... | 150,800 | 141,800 | +6.3 | 88,700 | 84,100 | 45,900 | 42,000 | 4,600 | 4,600 | 11,600 | 11,100 | 64,450 | 62,950 |
| Nov.... | 158,000 | 148,300 | +6.5 | 94,300 | 89,100 | 47,200 | 43,200 | 5,000 | 4,900 | 11,500 | 11,100 | 64,020 | 62,600 |

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund.

TABLE IV—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL PLANTS IN THE UNITED STATES*
(100 Per Cent of the Industry)

| Month | Energy Generated | | | | | | Fuel Consumption | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hydro-Plants | | | Fuel Power Plants | | | Coal | | | Oil | | | Gas | | |
| | 1927 Thousands of Kw.-Hr. | 1926 Thousands of Kw.-Hr. | Per Cent Increase | 1927 Thousands of Kw.-Hr. | 1926 Thousands of Kw.-Hr. | Per Cent Increase | 1927 Short Tons | 1926 Short Tons | Per Cent Increase | 1927 Barrels | 1926 Barrels | Per Cent Increase | 1927 Thousands of Cubic Feet | 1926 Thousands of Cubic Feet | Per Cent Increase |
| August.... | 2,371,572 | 2,062,629 | +14.9 | 3,963,763 | 3,715,124 | +6.7 | 3,180,358 | 3,060,647 | +3.9 | 480,022 | 728,864 | —34.1 | 6,259,785 | 5,403,316 | +15.8 |
| September. | 2,168,531 | 2,033,312 | + 6.7 | 4,100,283 | 3,792,540 | +8.1 | 3,242,546 | 3,114,535 | +4.1 | 478,816 | 883,913 | —45.9 | 6,474,756 | 4,816,955 | +34.4 |
| October.... | 2,349,720 | 2,122,336 | +10.7 | 4,226,905 | 4,052,623 | +4.3 | 3,332,673 | 3,317,113 | +0.5 | 480,848 | 879,929 | —45.5 | 6,439,602 | 4,872,740 | +32.1 |
| November. | 2,456,836 | 2,193,093 | +12.0 | 4,046,606 | 3,870,691 | +4.5 | 3,225,764 | 3,193,212 | +1.0 | 485,291 | 926,916 | —47.5 | 5,687,217 | 3,975,408 | +43.1 |

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

## Baltimore Consolidated Leads New Capital Issues

During the week ended Jan. 26 the Consolidated Gas, Electric Light & Power Company of Baltimore issued 5 per cent cumulative preferred stock, series A, to the amount of $10,000,000, the price being 100 and accrued dividend. The issue totaled $13,500,000, but $3,500,000 of that sum was reserved by the company for local subscription. The proceeds of the offering will be used to provide funds, in part, for the retirement of $5,000,000 series A 8 per cent, $2,000,000 series B 7 per cent and $4,000,000 series C 6½ per cent cumulative preferred stocks, which issues will be redeemed April 2, 1928, and to reimburse the treasury in part for the cost of additions and extensions and for other capital expenditures.

The Central States Utilities Corporation offered ten-year 6 per cent secured gold bonds to the amount of $3,000,000, the price being 90 and accrued interest to yield about 6.25 per cent. The Central States Utilities Corporation will own all of the outstanding common stock of the Central States Power & Light Corporation.

First mortgage gold bonds of the Washington Gas & Electric Company were offered at 100 and accrued interest.

## National Power & Light And Lehigh Power Merge

S. Z. Mitchell, president of Electric Bond & Share Company stated this week that a plan has been formulated for the exchange of stock of Lehigh Power Securities Corporation for stock of National Power & Light Company. He said that the basis of exchange is one share of $6 preferred stock of the National Power & Light Company for each share of $6 preferred stock of the Lehigh Power Securities Corporation, and one share of the common stock of the National Power & Light Company for each share of the common stock of the Lehigh Power Securities Corporation, and that this privilege of exchange is extended to all stockholders of Lehigh Power Securities Corporation.

Mr. Mitchell stated that while the two companies are remarkably similar as to amount of earnings and share capitalization the character of the business in the communities served by the two groups is quite different. In his opinion, the Lehigh Power Securities Corporation stockholders making the exchange, as well as the stockholders of the National Power & Light Company, will benefit substantially by the business and geographic diversity and the greater financial strength and stability resulting from the union of the two groups.

## Company Reports

| Name of Company | Gross Earnings Twelve Months Ended Nov. 30 1927 | 1926 |
|---|---|---|
| American Wtr. Wks. & Elec. | $48,706,743 | $45,013,322 |
| Associated Gas & Electric | 34,440,164 | 28,802,770 |
| Columbia Gas & Electric | 96,926,462 | 92,210,312 |
| Electric Power & Light | 52,499,277 | 49,425,346 |
| Fort Worth Power & Light | 2,978,740 | 2,871,401 |
| Idaho Power | 3,118,953 | 2,872,883 |
| Illinois Power & Light | 31,286,067 | 30,953,021 |
| Kansas City Power & Light | 12,275,468 | 10,801,037 |
| Nebraska Power | 4,824,915 | 4,365,989 |
| New York Power & Light | 18,789,733 | 17,840,022 |
| Pacific Power & Light | 3,751,229 | 3,745,490 |
| Public Service of New Hampshire | 3,665,361 | 3,586,583 |
| Texas Power & Light | 9,433,144 | 7,575,571 |
| United Light & Power subs. | *41,158,953 | *36,682,193 |
| Utah Power & Light | 10,646,581 | 10,437,622 |
| West Penn Electric | 37,123,471 | 34,101,919 |

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday Jan. 24 | Low 1927 | High 1927 |
|---|---|---|---|
| **ABITIBI PWR. & PAPER, 4% com.—no par** | 163 | 140½* | 164* |
| Ala. Pwr., $7 com. pf.—no par | 114½ | 107 | 115 |
| Allis Chalmers Mfg.,6% com.ex.div. | 118½ | 115½* | 120½* |
| Aluminum Co. of Amer., com. | 124½ | 120* | 125* |
| Aluminum Co. of Amer., 6% pf. | 106½ | 105½* | 106½* |
| Amer. d‡Foreign Pwr., 7% pf.—no par | 108 | 105½* | 108½* |
| Amer. & Foreign Pwr., com.—no par | 26 | 22½* | 27½* |
| Amer. Bosch Magneto, com.—no par | 20½ | 20* | 22½* |
| Amer. Brown Boveri Elec.† | 15½ | 14½* | 17* |
| Amer. Brown Boveri Elec., pf. $7 | 61 | 58* | 63* |
| Amer. Gas & Elec., 6% pf.—no par | 106½ | 106½* | 109* |
| Amer. Gas & Elec., com. †—no par | 124½ | 117½* | 122½* |
| Amer. Lt. & Trac., 6% pf. | 115½ | 115½* | 115½* |
| Amer. Lt. & Trac., new com. | 173 | 170* | 174½* |
| Amer. Pwr. & Lt., 6% pf. | 107½ | 107½* | 109½* |
| Amer. Pwr. & Lt., com. †—no par | 65½ | 62½* | 65½* |
| Amer. Pub. Serv., 7% pf. | a 99 | 94 | 104 |
| Amer. Pub. Serv., com. † | k 70 | 65 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | 92 | 73 | 90 |
| Amer. Pub. Utilities, 7% pr. pf. | a 93 | 92 | 96½ |
| Amer Pub. Utilities, com. | k 60 | 58 | 70 |
| Amer. States Sec., A | 4 | 2½ | 5½ |
| Amer. States Sec., B | 4½ | 2½ | 5½ |
| Amer. Superpwr., 6% ptc pf.—25 | 29½ | 29* | 29½* |
| Amer. Superpwr., 6% 1st pf. | l 103 | .... | .... |
| Amer. Superpwr., Class A†—no par | 40 | 37* | 40½* |
| Amer. Superpwr., Class B†—no par | 40½ | 37½* | 40½* |
| Amer. Wtr. Wks. & Elec., 6% pf. | 103 | 101½* | 103½* |
| Amer. W.W. & E., com. new—no par | 58 | 56½* | 61* |
| Anaconda Copper cap. $3 | 57½ | 53½* | 59½* |
| Appalachian Electric Pwr., 7% pf. | 109 | 100 | 109 |
| Arkansas Pwr., & Lt. 7% pf. | 107½ | 101 | 108 |
| Assoc. Gas & Elec., $3.50—50 | 54 | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par | 98 | 85 | 98 |
| Assoc. G. & E., Class A, 10—no par. | 47½ | 47½* | 51½* |
| **BABCOCK & WILCOX, 7% com.** | 124½ | 120* | 124½* |
| Binghamton L., H. & P., $6 pf. | 103 | 93 | 103½ |
| Birmingham Elec., pf.—$7—no par. | 109 | 105 | 111½ |
| Blackstone Valley G. & E., 6% pf. | k107 | 103 | 110 |
| Blackstone Valley Gas & Elec., 10% com.—50 | k128 | 98 | 153 |
| Blaw-Knox, com.† | m 93½ | 70 | 105 |
| Brazilian Trac., Lt. & Pwr., $7 com. | f223½ | .... | .... |
| Broad River Pwr., 7% pf. | 104 | 97 | 105½ |
| Brooklyn Edison, 8% com. | 225½ | 206½* | 235½* |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | l 26½ | .... | .... |
| Buffalo, Niagara & East. Pwr. com. $1.20—no par | l 34½ | .... | .... |
| **CALIFORNIA ELEC. GENERATING, 6% pf.** | k 98 | 96 | 104½ |
| California Ry. & Pwr., 7% pf. | k135 | 125 | 150 |
| Carolina Pwr. & Lt., pf.—$7—no par | f110 | 109* | 110½* |
| Central & S. W. Util., $7 pf.—no par | a104½ | 92½ | 99½ |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a107½ | 98½ | 105½ |
| Central Ark. Ry. & Lt., 7% pf. | 104 | 100 | 107 |
| Central Ill. Pub. Serv., $6 pf. | a 98 | 85½ | 100 |
| Central Ind. Pwr., 7% pf. | a 96½ | 85½ | 95½ |
| Central Maine Power, 6% pf. | 95 | .... | .... |
| Central Maine Power, 7% | 106 | 102 | 110 |
| Central Pwr. & Lt., 7% pf. | 105 | 100½ | 105 |
| Central States Elec., 7% pf. | 104½ | 104½* | 105½ |
| Century Elec., 6% com. | b145 | 140* | 142* |
| Chicago Fuse Mfg., com.—$2.50 no par | a 32 | 30 | 35½ |
| Cincinnati Gas & Elec., 5% com. | g100 | .... | .... |
| Cities Service, $6 pf.—no par | f95½ | 87½ | 94½* |
| Cities Service, pf. B—no par | f 9 | 8* | 8½* |
| Cities Service, pf. BB—no par | f 90 | 80½* | 86* |
| Cities Service, com.—20 | f55½ | 40½* | 58½* |
| Cities Service, Bks. Shrs.—10 | f27½ | 22½* | 27 * |
| Cities Service Pwr. & Lt., 7% pf. | k105½ | 105½* | 106½* |
| Cities Service Pwr. & Lt., 6% pf. | 96½ | 95½* | 96½* |
| Cleveland Elec. Illg., 6% pf. | 112 | 108 | 114 |
| Cleveland Elec. Illg., 10% com. | 350 | 285 | 370 |
| Columbia Gas & Elec., 6% pf. | 108½ | 108* | 110½* |
| Columbia G. & E. com. $5—no par. | 92½ | 89½* | 92½* |
| Columbus Elec. & Pwr., $2 com.—no par. | m 65 | .... | .... |
| Columbus Elec. & Pwr., 7% pf. | 110 | .... | .... |
| Columbus Ry., Pwr.&Lt., 6%, 1st pf. | 107 | 98½ | 108½ |
| Columbus Ry., Pwr. & Lt., 6½% pf. B | 105 | 96 | 106 |
| Columbus Ry., P.& l t. com.—no par | 105 | 75 | 110 |
| Commonwealth Edison, 8% com. | a168 | 138 | 173 |
| Commonwealth Pwr., 6% pf. | 102½ | 102½* | 104½* |
| Commonw'th Pwr., $2, com.—no par | 65½ | 62½* | 65½* |
| Conn. Lt. & Pwr., 8% pf. | 121 | 119 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 117 | 112 | 119 |
| Cons. Gas of N. Y., pf. | 102½ | 101½* | 102½* |
| Cons. Gas of N. Y., com. $5—no par. | 126½ | 119½* | 126½* |
| Cons. Gas, Elec. Lt. & Pwr. of Baltl., 6% pf. | e113 | 110½ | 112½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf. | e110½ | 110½ | 114½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf. | e110½ | 112½ | 117 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf. | e125½ | 127 | 130½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par. | e 70½ | 51 | 71 |
| Consolidated Pwr. & Lt., 7% pf. | 105 | 100 | 106 |
| Consumers Pwr., 6% pf. | 104½ | 100 | 106½ |
| Consumers Pwr., 6.6% pf. | 106½ | 103 | 107½ |
| Continental Gas & Elec., 8% ptc. pf. | 110½ | 103 | 110 |
| Continental Gas & Elec., 7% pr. pf. | 107½ | 100 | 107½ |
| Conti. G. & E. com. $4.40—no par. | k225 | 210 | 265 |
| Crocker Wheeler, com.† | 25 | 23 | 38 |
| Crocker Wheeler, 7% pf. | 85 | 78 | 88 |
| **DALLAS PWR. & LT., 7% pf.** | 111 | 107 | 111½ |
| Dayton Pwr. & Lt., 6% pf. | 108½ | 101 | 109½ |
| Detroit Edison, 8% com. | 174 | 166½* | 176½* |
| Dubilier Condenser, com.—no par. | 3 | 2½* | 3½* |
| Duke Pwr., cap. | 136½ | 136* | 145* |
| Duquesne Lt., 7% pf. | 116 | 115½* | 116* |
| **EASTERN NEW YORK UTIL., $7 pf.** | k110½ | 102 | 112½ |
| Eastern New York Util. com. | k 65 | 70 | 75 |
| Eastern States Pwr. $7, com. | 13½ | 11½* | 13½* |
| Eastern States Pwr., pf. | 97 | 90 | 99 |
| East. Tex. Elec., 7% pf. | 108 | 106 | 109 |
| Edison Elec.of Boston, $12 com. | d263 | 217 | 267 |
| El Paso Elec. 7% pf. | 110½ | 105 | 112½ |
| Elec. Bond & Share, 6% pf. | 110 | 109½* | 111½* |
| Elec. Bd. & Sh. Sec., com. $1—no par | l 78½ | 76* | 80½* |
| Electric Household Util.† | a 15½ | 11 | 15½ |
| Elec. Investors, 6% pf.—no par. | 102 | 92 | 101 |
| Elec. Investors, com.†—no par. | 43½ | 40½* | 44* |
| Elec. Pwr. & Lt., ctfs. pf. | 107½ | 106½* | 107½* |
| Elec. Pwr. & Lt., ctfs., 40% pd. | k123½ | 120½* | 121½* |
| Elec. Pwr. & Lt., ctfs., com.—no par | 33½ | 28½* | 34½* |
| Elec. Refrig. cap.† | 12½ | 11½* | 13½* |
| Elec. Ry. Securities, com.—no par. | 6½ | .... | .... |
| Elec. St. Battery com. $5.25—no par | 71½ | 69½* | 75½* |
| Elmira Wtr., Lt. & R.R., 7% pf. | k105 | 99 | 105½ |
| Empire Pwr. ptc.† | m 30½ | 27½* | 30½* |
| Engr. Pub. Serv. $7. pf.—no par. | 108 | 107* | 109* |
| Engr. Pub. Serv., com.—no par. | 36½ | 34½* | 36½* |
| Eureka Vacuum Cleaner, com. $4—no par. | 75½ | 73½* | 79* |
| **FAIRBANKS MORSE, 7% pf.** | k106 | 107 | 112 |
| F.-M., com.—$3—no par. | 38½ | 32½* | 40½* |
| Federal Lt. & Trac., com $1.40. | 47½ | 42* | 47½* |
| Federal Lt. & Trac., $6 pf.—no par. | 1u2 | 98* | 103* |
| Florida Pwr. & Lt., 7% pf. | 106½ | 104½* | 106½* |
| Ft. Worth Pwr. & Lt., 7% pf. | d113½ | 113* | 114½* |
| **GALVESTON-HOUSTON ELEC. 6% pf.** | 75 | 68 | 85 |
| Galveston-Houston Elec., com. | 31½ | 26 | 32 |
| General Cable, Cl. A $1 no par. | 60 | 56½* | 60* |
| Gen. Elec. $3 com.—no par. | 134½ | 130* | 138½* |
| Gen. Elec., special—6% | 11½ | 11½* | 11½* |
| Gen. Gas & Elec. (Del.) com A $1.50—no par. | 38½ | 35½* | 38½* |
| Gen. G. & E. (Del.) pf. A. $8—no par | k122½ | 113½ | 123½ |
| Gen. G. & E. (Del.) pf. A $7—no par. | k109½ | 100 | 110½ |
| Gen. G. & E. (Del.) pf. B $7. | k105 | 96* | 105½* |
| Gen. Pub. Serv., $7 cum. pf., no par. | k110 | 102 | 112 |
| Gen. Pub. Serv., com., no par. | 19½ | 16½* | 19½* |
| Ga. Ry. & Pwr., 8% pf. | k125 | 119 | 125 |
| Ga. Ry. & Pwr., 7% pf. | k113½ | 106 | 115 |
| Gt. Western Pwr., 7% pf. | k105 | .... | .... |
| **IDAHO PWR., 7% pf.** | 109 | 103 | 110 |
| Ill. No. Utilities, 6% pf. | k 96 | 88 | 97 |
| Ill. Pwr. & Lt., 7% pf. | 104 | 99 | 104½ |
| Ingersoll Rand com. | k 92 | 91* | 94* |
| Int. Combus. Engr., com. $2—no par | 53½ | 49* | 55½* |
| Int. Combustion Engr.,7% pf. | k105½ | 104½* | 105½* |
| Int. Util., Class A—$3.50—no par. | 48 | 48* | 51½* |
| Int. Utilities, Class B—no par. | 9½ | 9½* | 10½* |
| Interstate Pwr., pf.—$7—no par. | 97½ | 93 | 100 |
| Interstate Pub. Serv., 7% pf. | 102 | 98 | 104 |
| Iowa Ry. & Lt., 7% pf. | k 98½ | 97 | 100 |
| **JERSEY CENTRAL PWR. & LT. CO., 7% pf.** | 105½ | 97½ | 108 |
| Johns-Manville. com.†—no par. | k114½ | 114½* | 123* |

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; f Montreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Jan. 21. lBid price Wednesday, Jan. 25. mLatest quotations available. †Dividend rate variable. *1928

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday Jan. 24 | Low 1927 | High 1927 |
|---|---|---|---|
| **KANSAS CITY PWR. & LT. pf. $7** | 115½ | 115* | 115½* |
| Kansas Gas & Elec., 7% pf. | *l*108½ | 107* | 109* |
| Kentucky Hydro-Elec., 7% pf. | *a*103 | 94½ | 104 |
| Kentucky Sec., 6% pf. | 91 | 83 | 90 |
| Kentucky Sec., 5% com. | 140 | 100 | 135 |
| Kentucky Utilities, 6% pf. | *k*101 | 95 | 101½ |
| **LACLEDE GAS LT., 12% com.** | 218½ | 200* | 218½* |
| Lehigh Pwr. Sec., com.—no par | 23½ | 19½* | 23½ |
| Long Island Ltg., 7% pf. | 110½ | 107 | 112½ |
| Long Island Ltg., com.†—no par | 170 | 139 | 180 |
| Los Angeles Gas & Elec., 6% pf. | 104½ | 98 | 105 |
| Louisville Gas & Elec., cl. A. $1.75 | 28½ | 28½* | 29* |
| **MAN. ELEC. SUPPLY, cap. $5—no par** | 52 | 50* | 54½* |
| Manila Elec., com.†—no par | *k* 45½ | 40 | 60 |
| Maytag Mfg., com. .50—no par | 34 | 33½* | 34½* |
| Memphis P. & L., pf.—$7—no par | *k*109 | 107 | 111 |
| Metropolitan Ed., pf.—$6—no par | 104½ | 93 | 106 |
| Metropolitan Ed., pf.—$7—no par | 108 | 104 | 110 |
| Metropolitan Ed., com. $5—no par | *k*125 | 60 | 72 |
| Middle West Utilities, 7% pf. | *a*122½ | 110¾ | 119 |
| Middle West Util., 7% pr. lien | *a*128 | 117½ | 127 |
| Middle West Util., com. $6—no par | *a*134 | 108 | 125 |
| Midland Utilities, pr. ln. 6% pf. | *a*106 | 91½ | 96¼ |
| Midland Utilities, 7% pf. A | *a*103½ | 96½ | 103½ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | *k*103 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | *k* 99 | 98 | 101½ |
| Minn. Pwr. & Lt., 7% pf. | *l*108½ | 107* | 109* |
| Miss. River Pwr., 6% pf. | 107½ | 94 | 108 |
| Miss. River Pwr., 3% com. | *m* 62 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | *k*109 | 100 | 109 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | *k*104 | 105* | 106* |
| Mohawk Hudson Pwr., com.—no par | 30½ | 29½* | 30½* |
| Montana Pwr., 5% com. | 125½ | 102½* | 125½* |
| Montreal Pwr., 7% com. | *f* 94 | .... | .... |
| Mountain States Pwr., 7% pf. | *k*102½ | 97 | 103 |
| Mountain States Pwr., com.† | 17 | .... | .... |
| **NASSAU & SUFFOLK LTG., 7% pf.** | 110 | 98 | 110 |
| National Carbon, 8% pf. | *m*139 | 130½ | 139½ |
| National Elec. Pwr., A† | *a* 28 | 22 | 28½ |
| National Lt., Ht. & Pwr., com. | *k* 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | *k* 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | 110 | 108½* | 110* |
| National Pwr. & Lt., com.†—no par. | 24½ | 21½* | 25* |
| National Pub. Serv., 7% pf. | 100 | 93 | 102 |
| National Pub. Serv., 7% ptc., pf. | 114 | 108 | 115 |
| National Pub. Serv., A com. $1.60—no par | 23 | 22* | 23* |
| National Pub. Serv., B com.—no par | 27½ | 24½* | 27½* |
| Nebraska Pwr., 7% pf. | *l*110½ | 110* | 111½* |
| Nevada-Calif. Elec., com. | *k* 33 | 22 | 37 |
| New Brunswick Pwr., 4% pf. | *k* 60 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | *k*104 | 98½ | 104 |
| New Eng. Pub. Serv., pf. $7 | *k*102 | 101* | 102½* |
| New Orleans Pub. Serv.—7% pf. | 108½ | 103 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf. | *k*103 | 101 | 104 |
| New York Power & Light 8% pf. | 114 | .... | .... |
| New York Power & Light, 7% pf. | 114 | .... | .... |
| Newport News & Hampton Ry., Gas & Elec., 5% com. | *k*109 | 110 | 115 |
| Newport News & Hampton Ry., Gas & Elec., 7% pf. | *k*109 | 110 | 115 |
| Niagara Falls Pwr., 7% pf.—25 | 28½ | 28* | 28½* |
| No. Amer., 6% pf.—50 | *k* 54½ | 53½* | 54½* |
| No. Amer., com.—10 | 61½ | 58½* | 62½* |
| No. Amer. Edison, $6 pf.—no par | *k*105 | 103½* | 104½* |
| No. Caro. Pub. Serv., pf.—$7—no par | 105 | 93 | 105 |
| Northeastern Pwr., com. | 21½ | 19½* | 21½* |
| No. N. Y. Utilities, 7% pf. | 107 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 20 | 18* | 21½* |
| No. Ont. Lt. & Pwr., 6% pf. | *k* 98 | 84 | 95 |
| No. Ont. Lt. & Pwr., 4% com. | *k* 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf. | 108½ | 108½* | 109½* |
| No. States Pwr. (Del.), 8% com. | 130 | 123* | 130* |
| No. Texas Elec., 6% pf. | 47 | 45 | 70 |
| No. Texas Elec., com. | 17 | 5 | 36 |
| **OHIO BRASS, com. B $4—no par.** | 95 | 89* | 95½* |
| Ohio Brass, 6% pf. | *k*106 | 100 | 111 |
| Ohio Pwr., 6% pf. | 105½ | 96 | 106 |
| Ohio Pub. Serv., $6 pf. | *k*102 | 95 | 102 |
| Ohio Pub. Serv., 7% pf. | *k*109½ | 103 | 111 |
| Ohio River Edison, 7% pf. | 108½ | 103 | 109½ |
| Oklahoma Gas & Elec., 7% pf. | 110½ | .... | .... |
| **PACIFIC Gas & ELEC., 6% pf.** | 27½ | 26½* | 27½* |
| Pacific Gas & Elec., 8% new com. | 48 | 47½* | 48½* |
| Pacific Pwr. & Lt., 7% pf. | *l*108½ | 106* | 108½* |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | *c* 79 | 75½ | 80 |
| Penn-Ohio Edison, 6% pf. no par | *k* 90 | 94½* | 96* |
| Penn-Ohio Edison, 7% pf. | 108 | 107* | 109* |
| Penn-Ohio Pwr. & Lt., 7% pf. | 109½ | 99 | 110 |
| Penn Pwr. & Lt.—$7—no par | *l*109½ | 109½* | 110½* |
| Penn Wtr. & Pwr., 8% com., new | *e* 70 | 47½ | 75 |
| Phila. Co., 5% pf.—50 | *k* 48½ | 40 | 51 |
| Phila. Co., 6% pf.—50 | 52½ | 52* | 52½* |
| Phila. Co., com.—50 | 154½ | 149½* | 154½* |
| Phila. Elec., 8% com.—25 | *c* 58½ | 46 | 58½ |
| Portland Elec. Pwr., 7% pf. | 103 | 97½ | 102½ |
| Portland Elec. Pwr., 6% pf. | 88 | 78 | 84 |
| Portland Elec. Pwr., 6% 2d pf. | 78 | 55 | 70 |
| Portland Elec. Pwr., com. | 33 | 22 | 30 |
| Potomac Elec. Power, pf. | *k*111 | 110 | 111½ |
| Pwr. Sec., pf.—no par | 62½ | 62* | 62½* |
| Pwr. Sec., com.—no par | *k* 12 | 5 | 15 |
| Public Serv. of Colorado, 7% pf., | *l*107 | 99* | 103* |
| Pub. Serv. of N. J., 6% pf. | 104½ | 103½* | 105* |
| Pub. Serv. of N. J., 8% pf. | *k*134 | 134* | 135* |
| Pub. Serv. of N. J., $2 com.—no par | 43½ | 41½* | 43½* |
| Pub. Serv. of No. Ill., 6% pf. | *a*111 | 101½ | 113½ |
| Pub. Serv. of No. Ill., 7% pf. | *m*120½ | 112½ | 120½ |
| P. S. of No. Ill., com. $8—no par | *a*161½ | 140½ | 161½ |
| Pub. Serv. of No. Ill., $8 com. | *a*160 | 132 | 161½ |
| Pub. Serv. of Okla., 7% pr. ln. | *k*103 | 90 | 103 |
| Pub. Serv. Elec. & Gas, 6% pf. | 110 | 109* | 110* |
| Puget Sound Pwr. & Lt., 7% pf. | 112 | 110* | 112* |
| Puget Sound Pwr. & Lt., $6 pf.—no par | *m* 99 | .... | .... |
| Puget Sound Pwr. & Lt., com. | 46½ | 34½* | 46½* |
| **RADIO COPR. OF AMER., $3.50 pf.—50** | 55½ | 54½* | 57½* |
| Radio Corp. of Amer., com.—no par | 103½ | 88½* | 104½* |
| Rhode Island Public Service, pf. $2—no par | 31 | 30½* | 31* |
| Rochester Gas & Elec. 6% pf. D | 105½ | 101 | 103½ |
| Rochester Gas & Elec., 7% pf. B | 107 | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C | 105½ | 101½ | 103½ |
| **SAN JOAQUIN Lt. & Pwr., 7% pr. pf.** | *k*111 | 105 | 112½ |
| St. Joseph Ry., L., H. & P., 5% pf. | *k* 75 | 70 | 75 |
| Servel Corp. | 5½ | 4½* | 6½* |
| Sierra Pacific Elec., 2% com. | *m* 32 | 24½ | 31½ |
| Sioux City Gas & Elec., 7% pf. | 107 | 99 | 105½ |
| Southeastern Pwr. & Lt., pf.—$7—no par | *m*108 | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | *i* 89½ | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 44½ | 42* | 44½* |
| So. Calif. Edison, 8% pf. | *k* 45 | 36½ | 40 |
| So. Calif. Edison, 7% pf. | *k* 28 | 27½ | 28½ |
| So. Calif. Edison, 6% pf. | *k* 26 | 24½ | 27 |
| So. Calif. Edison, 8% com. | 44½ | 43½* | 44½* |
| Southern Cities Utilities, 7% pf. | *k* 73 | 67 | 90½ |
| Southwestern Lt. & Pwr., A $3 | 70 | 60 | 65 |
| Southwestern Lt. & Pwr., B | 70 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf. | 90 | 83 | 91½ |
| Southwestern Pwr. & Lt., 7% pf. | 110½ | 110* | 110½* |
| Standard Gas & Elec., 8% pf. | 66½ | 65* | 66½* |
| Standard Gas & Elec., 7% pr. pf. | 110½ | 103 | 113 |
| Standard G. & E., com. $3.50 | 61½ | 57½* | 61½* |
| Standard Power & Light, com. | *m* 30 | 30* | 33½* |
| Standard Pwr. & Lt., 7% pf. | 104 | 103½* | 105* |
| Staten Island Edison, pf.—$6—no par | 102 | 99 | 103 |
| Superheater, $6 com.—no par | 170 | 170 | 185 |
| Syracuse Lighting, 7% pf. | *k*111 | 103 | 111 |
| Syracuse Lighting, 8% pf. | *k*117½ | 114 | 119 |
| **TAMPA ELEC., com. $2** | *m* 63 | 62½* | 63* |
| Tenn. Elec. Pwr., 6% pf. | 102½ | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109½ | 103 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf. | *k* 26 | 20 | 30 |
| Terre Haute, Ind. & East. Trac., com. | *k* 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf. | *l*113½ | 113½* | 115* |
| Tide Water Pwr., 8% pf. | 109 | 105 | 111 |
| Timken Roller Bear., com.—$4 no par | 131½ | 126½* | 134* |
| Toledo Edison, 7% pf. | *l*109 | 102* | 107* |
| Toledo Edison, 6% pf. | *k*103 | 95 | 105 |
| Toledo Edison, 6% com. | *k*100 | 93 | 102 |
| Tri-City Ry. & Lt., 6% pf. | *k* 97½ | 96 | 99 |
| **UNITED GAS & ELEC., 7% pf.** | 101½ | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 74 | 70 | 77 |
| United Gas Impr., 8% com.—50 | *c*117½ | 89½ | 118½ |
| United Lt. & Pwr., pf.—$4—no par. | *a* 55 | 50 | 57 |
| United Lt. & Pwr., pf.—$6.50—no par. | *a* 98½ | 87 | 97½ |
| United L. & P., com. A .48—no par. | *a* 15 | 13½* | 14½* |
| United L. & P., com. B .48—no par. | *a* 20 | 14 | 20 |
| Utah Pwr. & Lt., 7% pf. | *l*111½ | 109½* | 111* |
| Utica Gas & Elec., 7% pf. | 106 | 105 | 106½ |
| Utica Gas & Elec., 8% com. | *k*200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 98 | 93 | 100 |
| Utilities Pwr. & Lt., com. A $2. | 29½ | 28½* | 29½* |
| Utilities Pwr. & Lt., com. B $1—no par | 20½ | 18½* | 20½* |
| **VERMONT HYDRO-ELEC., 7% pf.** | *k* 97 | 95 | 100 |
| Virginia Elec. & Pwr., 7% pf. | *k*108 | 105 | 110 |
| **WAGNER ELEC., 7% pf.** | *b* 98 | 96½* | 98* |
| Wagner Elec., com.—no par | *b* 39½ | 37½* | 38½* |
| Washington Ry. & Elec., 5% com. | 460 | 180 | 475 |
| Washington Ry. & Elec., 5% pf. | 102½ | .... | .... |
| Washington Wtr. Pwr., 8% com. | *k*215 | 136 | 182 |
| West Penn Elec., 7% pf. | 111½ | 111½* | 114½* |
| West Penn Elec., Cl. A $7. | 109 | 106½* | 109* |
| West Penn Pwr., 7% pf. | 116 | 114½* | 116½* |
| West Penn Pwr., 6% pf. | 110 | 109½* | 113* |
| West Virginia Lt., Ht. & Pwr., 7% pf. | *k* 95 | 94 | 100 |
| Western Pwr., 7% pf. | *k*102 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 102 | 96 | 106 |
| Western States Gas & Elec., com. | 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 100½ | 88½* | 100½* |
| Weston Elec. Instrument, Cl. A $2—no par | *k* 31 | 30 | 34½ |
| Weston Elec. Instrument, com.—no par | 14 | 12½* | 14* |
| Wheeling Elec., 6% pf. | *k*103 | 95 | 104 |
| Worthington Pump, 7% pf. A | 51 | 46½* | 51* |
| Worthington Pump, 6% B | 44½ | 41* | 44½* |
| Worthington Pump, com. | 31½ | 28* | 31½* |
| **YALE & TOWNE com. $5—25** | *k* 74 | 73½* | 75* |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Jan. 21. *l*Bid price Wednesday, Jan. 25. *m*Latest quotations available. †Dividend rate variable. *1928

## New Italian Superpower Corporation Organized

Under Delaware laws, the Italian Superpower Corporation has been organized with the purpose of acquiring substantial but not controlling interests in virtually all of the principal electric light and power companies in Italy. As a result of the progressive measures put into effect in recent years, Italy has started a remarkable development of her hydro-electric resources, and with the modern adaption of electricity to practically every line of industry and the assistance of American capital further phenomenal growth along these lines is expected in the future.

The first piece of financing for Italian interests to appear in the American investment markets since the placing of the embargo on foreign loans by the Italian government followed the announcement of the formation of the new company. Thirty-five-year 6 per cent debentures of the Italian Superpower Corporation were offered at 100 and accrued interest to the amount of $20,250,000. Common stock and option warrants were attached. These debentures will be followed by 124,172 shares of preferred stock and 970,000 shares of common stock class "A" (including 202,500 shares to be deposited with the Bankers Trust Company, New York, in connection with the option warrants to be outstanding) and 150,000 shares of common stock class "B."

L. K. Thorne, president of Bonbright & Company, Inc., and chairman of the American Superpower Corporation, is chairman and president of the Italian Superpower Corporation. The management will include officials of many large American utilities. In addition to Mr. Thorne the directorate includes: S. Z. Mitchell, Gerard Swope, C. H. Minor, E. P. Currier, Marshall Field, P. G. Gossler, J. W. Maitland, B. C. Cobb, C. E. Calder, Giuseppe Toeplitz, Silvio Crespi, Ettore Conti, Guido Donegani, Siro Fusi, Achille Gaggia, Rinaldo Panzarasa, Pasquale Simonelli, Michelangelo Facconi and Guido Semenza.

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WORCESTER UTILITY INCREASES DIVIDEND.—Directors of the Worcester Electric Light Company have declared a quarterly dividend of $1.50 a share, or 6 per cent, on the $25 par stock. This puts the stock on a regular $6 basis, as compared with a $4 basis previously in effect. Last year, in addition to the regular $4 dividend, the company paid an extra dividend of $1.50 to shareholders.

# Business News and Market Conditions

## Handbook on International Commercial Arbitration

The publication is announced by the American Arbitration Association of a new International Handbook on Commercial Arbitration by the International Chamber of Commerce. This publication has been made possible through the co-operation of the International General Electric Company and the American Arbitration Association in honor of the late Anson W. Burchard, first president of the American Arbitration Association and chairman of the board of the International General Electric Company. The commercial arbitration procedure for each country will be described first in separate pamphlet form, in order to be readily available to business men engaged in foreign trade with such countries. The first instalment of the handbook describing "Commercial Arbitration under Swiss Law" has just been published. When the brochures for all countries are issued they will be combined and published in bound volume form as a complete manual on the commercial arbitration laws of the world.

Louis K. Comstock, chairman of the arbitration committee of the American section of the International Chamber of Commerce and a director of the American Arbitration Association, commenting upon the importance of this publication to business men engaged in international trade, said:

"The publication in condensed form of the requirements of the commercial arbitration laws of the world and of the procedure thereunder, which will greatly facilitate the practice of arbitration in the settlement of such business misunderstandings as may arise in the course of international trade, was a project which Mr. Burchard had very much at heart. Hereafter when the American importer or exporter has a dispute with a business man in a foreign country and he wishes to settle by arbitration, he will know exactly what must be done under the requirements of the arbitration law of the country in which the arbitration is to be held and precisely what his rights and obligations may be. Now, because of the lack of such condensed and readily available information, the uncertainty regarding these requirements frequently discourages a reference to arbitration. The same information is being published in English, French and German."

## 1927 Production Operations Show 2 per Cent Increase

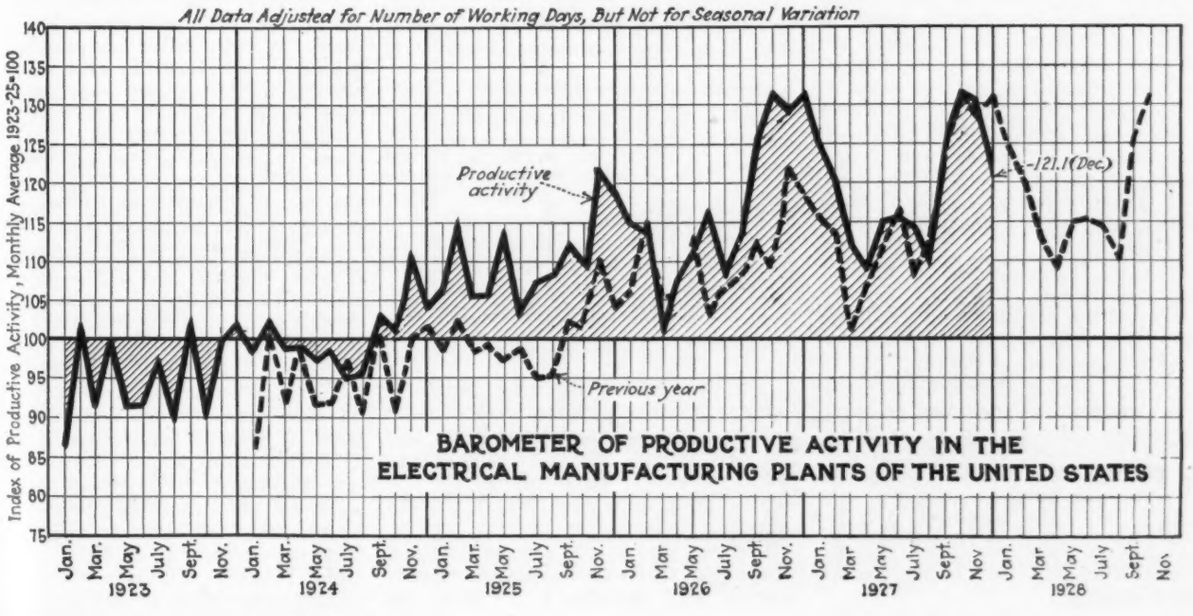
### Electrical Manufacturing Industry, However, Closed Last Year on a Plane 7.8 per Cent Under Year Previous—Gains Confined to First Half of the Year

WHILE the year just closed did not record the greatly increased productive operations in the electrical manufacturing plants of the nation witnessed during 1926, yet it did witness an increase in operations for the year as a whole of 2 per cent over the preceding twelve months. This gain in activities was confined almost exclusively to the first half of the year, operations since July being about on a level with or under the same period in 1926. The year 1927 closed with the rate of operations on a plane 7.8 per cent under December, 1926, the greatest twelve-month comparative drop in activities witnessed since 1923. The slight upturn in operations reported in December, 1926, did not take place last December.

The index of activity in the electrical manufacturing industry based on consumption of electrical energy stands at 121.1 for December as compared with 130.4 for November and 131.7 for December, 1926. Comparative indexes of productive activity, referred to the average activity for the period 1923-25 as 100 and adjusted for number of working days, are as follows:

| | |
|---|---|
| December, 1927 | 121.1 |
| November, 1927 | 130.4 |
| October, 1927 | 131.3 |
| December, 1926 | 131.7 |
| Average for full year 1927 | 119.2 |
| Average for full year 1926 | 117.0 |

The volume of production in American industry taken as a whole during 1927 was also 2 per cent above that reported for 1926. As with the electrical manufacturing industry, the gains made in productive operations by general industry during 1927 were confined very largely to the first half of the year. General industry closed the year on a plane about 8 per cent over December, 1926, due mainly to improved conditions in the steel and automobile industries, although other industrial groups, such as chemicals and allied products, food and kindred products, lumber and its products, and paper and pulp, also reported operations at the close of 1927 on a scale above those witnessed at the close of 1926.



## *Delinquent Electrical Accounts*

(Data Supplied by National Electrical Credit Association)

NUMBER OF ACCOUNTS REPORTED

| Division | November 1926 | November 1927 | Per Cent Increase or Decrease | Eleven Months 1926 | Eleven Months 1927 | Per Cent Increase or Decrease |
|---|---|---|---|---|---|---|
| New York | 244 | 219 | −10.2 | 3,847 | 3,345 | −13 |
| New England | 150 | 164 | + 9.33 | 1,353 | 1,716 | +26.8 |
| Pacific Coast | 10 | 26 | +160 | 240 | 195 | −18.7 |
| Central | 687 | 700 | +1.89 | 9,322 | 9,717 | +4.23 |
| Middle and Southern Atlantic States | 150 | 177 | +18 | 2,051 | 1,862 | −9.22 |
| Total | 1,241 | 1,286 | +3.63 | 16,813 | 16,835 | +.13 |

TOTAL AMOUNTS REPORTED

| Division | November 1926 | November 1927 | Per Cent Increase or Decrease | Eleven Months 1926 | Eleven Months 1927 | Per Cent Increase or Decrease |
|---|---|---|---|---|---|---|
| New York | $42,131 | $29,476 | −30 | $569,750 | $517,554 | −9.16 |
| New England | 9,909 | 20,516 | +107 | 94,571 | 203,697 | +115.3 |
| Pacific Coast | 432 | 3,012 | +597 | 35,407 | 23,340 | −34 |
| Central | 69,573 | 78,236 | +12.5 | 1,029,831 | 1,070,081 | +3.91 |
| Middle and Southern Atlantic States | 22,940 | 17,118 | −25.4 | 244,520 | 223,182 | −8.73 |
| Total | $144,985 | $148,358 | +2.31 | $1,974,079 | $2,037,854 | +53.9 |

AVERAGE AMOUNTS

| Division | November 1926 | November 1927 | Eleven Months 1926 | Eleven Months 1927 |
|---|---|---|---|---|
| New York | $172 | $135 | $1,628 | $1,698 |
| New England | 66 | 125 | 998 | 1,306 |
| Pacific Coast | 43 | 115 | 1,520 | 1,588 |
| Central | 101 | 112 | 1,218 | 1,212 |
| Middle and Southern Atlantic States | 152 | 96 | 1,265 | 1,338 |

Note:—A sharp increase in accounts is reported by the New England division. This is owing to increased association activity in this section and not to adverse economic conditions.

# Market Conditions

BUYING is more active virtually throughout the country and manufacturers report many inquiries from industrial plants. In New England industrial equipment orders dominate the market, motor sales show a gain, and electric lighting is active. In the Eastern district there is an upward trend in inquiries, industrial motor sales are good, and electric bus equipment business looks promising. Many negotiations covering industrial plant business are under way in the Southeast. Five orders for textile motors and transformers, amounting to $25,000, were placed. Three were received from North Carolina, one from Louisiana and one from Georgia.

In the St. Louis district the tone of business is better. Industrial activity improves in the Middle West. A large utility company is now buying for maintenance requirements at the rate of $75,000 per day. On the Pacific Coast many projects are planned, including an apple refrigerating plant to cost about $250,000, a Los Angeles substation to cost about $225,000, and a plant for the Pacific Can Company to be erected in San Francisco at a cost of $500,000. A number of motors were purchased for the new Seattle cement plant of the Pacific Coast Company.

### *Metal Prices Slightly Higher —Market Quiet But Firm*

Prices of copper, lead, zinc and tin are all slightly higher than a week ago, though the market has not been active. The strength has resulted from increased disinclination by producers to sell, rather than to a good consuming demand. It is felt that buying for most metals is likely to improve within a week or two; in fact, it has been materially better this last week abroad. Excellent sales of copper in the export market during the last two or three days have been a marked influence in removing the pressure to sell on the part of the custom smelters. The copper that was available from such sources until Monday at 14 cents for Eastern deliveries is no longer obtainable, and all sales on Tuesday and Wednesday have been on the 14⅛-cent, Valley, basis. The market on Wednesday was very quiet and it was intimated by one seller that 14⅛ cents was unobtainable, but until actual business is accepted at lower figures, the market must be considered at least as fairly firm at that level. Certainly it is a firm quotation as far as the major producers are concerned, and has been all week. Whether there will be any renewed concessions on the part of the custom smelters depends on the continuance of foreign buying or the resumption of interest by domestic consumers.

NEW YORK METAL MARKET PRICES

| | Jan. 18, 1928 Cents per Pound | Jan. 25, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 14 | 14⅛ |
| Lead, Am. S. & R. price | 6⅛ | 6⅛ |
| Antimony | 10⅜ | 10⅜ |
| Nickel, ingot | 35 | 35 |
| Zinc spots | 5.95 | 6 |
| Tin, Straits | 54⅛ | 55⅛ |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper wire price Jan. 25, 1928, 15⅞ cents.

### *Business Trends Upward in Eastern District*

While there is an upward trend in inquiries and actual orders in the Eastern district, the situation as a whole can be termed "spotty." The primary demand centers on substation apparatus and industrial equipment. A leading manufacturer states that the call for heavy equipment is at low ebb, but that industrial motors of sizable capacity are showing better sales. A central-station company in the Middle West has placed an order for a 700-hp. motor unit for circulating-pump service, and commitments for several more of similar type are now pending from the same quarter. Another manufacturer reports a number of interesting prospects for the sale of substation apparatus in the metropolitan district and early orders are expected. Electric bus equipment business looks very promising. Steam railroads have been making inquiries for their proposed electrification requirements, and encouraging early spring sales are anticipated. A manufacturer of transformers says that there has been a marked increase in inquiries and orders during the past fortnight. A recent order from a New Jersey broadcasting station was for a 300-kw. transformer unit, with auxiliary equipment, totaling close to $18,000. A maker of porcelain insulators reports a better demand for high-tension equipment. A large order has recently been placed by a California utility for suspension insulators and other good business of this nature is looked for in the immediate future. The past two weeks show gross sales comparing well with the same period of a year ago. Electric marine equipment demand gives early promise in this district.

Immediate construction projects in the district include the following: The Pennsylvania Railroad Company, Philadelphia, Pa., is asking bids until Feb. 2, for transmission towers (Contract No. 7-1928). The Public Service Electric & Gas Company, Newark, N. J., plans an equipment, storage and distributing plant at Jersey City, estimated to cost $150,000. The Quaker City Cold Storage Company, Philadelphia, Pa., will soon ask bids on revised plans for an eleven-story cold storage and refrigerating plant to cost about $1,000,000. The **Gold Hosiery Company**, New York, plans a power plant at its mill at Milroy,

Pa., costing complete $150,000. The Baltimore & Ohio Railroad Company, Baltimore, Md., plans a power plant in connection with engine house, shops, etc., at Youngstown, Ohio, with complete project to approximate $1,000,000. The Consolidated Gas, Electric Light & Power Company, Baltimore, proposes to purchase the Harford County properties of the Northern Maryland Power Company, including system at Havre de Grace, and will extend transmission lines in that territory. The general purchasing officer, Panama Canal, Washington, D. C., will receive bids Feb. 9, for motors, conduits, cable, wire, transformers and other electrical and mechanical equipment (Panama Schedule 1855).

## *Active Market in Southeast—Inquiries Increase*

With inventories practically over, activity is to be noted in the electrical field in the Southeast. Inquiries from industrial plants continue to increase and conditions are better than for many months past. Many negotiations are under way which will undoubtedly result in satisfactory orders within the next few weeks. Central-station companies are buying in slightly better volume, though the orders are individually small, with few exceptions. The largest central station order was from Florida for power transformers amounting to approximately $20,000. Meters and transformers continue in good demand, one company's orders for distribution and small power transformers totaling about $3,300. This same company ordered a search-lighting unit costing $2,100. Two power companies placed orders for creosoted pine poles, one order amounting to $1,100 and the other, $1,000.

One manufacturer reports the receipt of five textile motor and transformer orders aggregating $25,000, three of the orders being from North Carolina, one from Louisiana and one from Georgia. There is a new textile mill project in Georgia, on which bids will be asked in the very near future, which will call for motors and wiring materials amounting to approximately $12,000 and transformers and substation, around $5,000. There are two electrification projects in the same state, one a textile mill and the other an ice plant, on which contracts are expected to be let this week. Three textile mills placed supply orders which averaged $1,000. Municipalities are buying little, though one town ordered weather-proof wire amounting to $800.

The Georgia Power Company has purchased the municipal distribution system in Gordon, which system was formerly supplied by the Central Georgia Power Company, an affiliated company. The rehabilitation and extension of the distribution system will be undertaken. Other construction activities are: The Alabama Cotton Mills Company, Haleyville, Ala., plans a new mill to cost $200,000. Miami, Fla., plans an improved lighting system in the business district. Miami Beach, Fla., is asking bids until Feb. 1, for an ornamental lighting system. The Florida Cold Storage Company, Orlando, Fla., plans a cold storage and refrigerating plant to cost $350,000. The Southeast Georgia Power Company plans improvements in the recently acquired power plant at Alma, Ga. The Columbus Electric & Power Company plans a transmission line from Hamilton to Talbotton, Ga., about 30 miles. The Island Utilities Company, Kansas City, Mo., will purchase the power plant at New Albany, Miss. The Crane Enamelware Company, Chattanooga, Tenn., plans plant additions to cost about $500,000. The American Glantzstoff Corporation, Elizabethtown, Tenn., will build a power plant at its proposed rayon mill, to cost complete about $2,000,000. The Edisto Public Service Company has acquired the municipal power plant at Allendale, S. C. The Savannah River Electric Company, Greenwood, S. C., has received permission for a hydro-electric power development on the Savannah River, near Clark's Hill, with an ultimate output of 120,000 hp. The Appalachian Electric Power Company plans a transmission line from Sullivan to Ralco, with substation installation, estimated to cost $40,000. The Monongahela-West Penn Public Service Company will build transmission lines to Fowlerstown, Franklin and neighboring points in West Virginia.

## *Buying More Active in New England District*

Active buying and an increasing number of inquiries are reported by manufacturers in the New England district. Industrial equipment orders dominate the market, and motor sales gained during the week. A manufacturer reported an order for fractional horse-power motors amounting to over $10,000, and a number of orders for ratings up to 20 hp. are noted. Textile mills are showing an interest in the individual drive plan and several group motor orders are pending. Heavier equipment buying is quiet though the inquiries for turbo-generator units are increasing and the prospects for a number of interesting sales are very encouraging.

Central station supplies are moving slowly, and general equipment and scheduled material is moving fairly well. Industrial electric heating is active and forecasts by a number of prominent manufacturers indicate a strong trend toward the adoption of this equipment. The Connecticut Light & Power Company reports an increase of 2,515 kw. connected heating load for 1927. Electric lighting is active. Electric arc-welding apparatus is in good demand; five units, 200 amp. to 2,000 amp., were recently sold. The general tone is more optimistic throughout this district. A central-station company plans to install a new synchronous condenser in the near future. Permit for a development of 50,000 hp. at Windsor Locks, Conn., has been granted in a recent court ruling. Building contracts show a gain over last year. The Central Falls Manufacturing Company, Central Falls, R. I., plans the rebuilding of its woodworking plant recently destroyed by fire with loss of about $100,000.

## *Industrial Activity Improves in Middle West*

Conditions in the Middle West are very favorable, with industrial activity on the increase. The various utility companies are busy and maintenance purchasing is quite large, running about $75,000 per day for one large company. Apparatus purchased includes a 60-ft. revolving car dumper including steel platform, motor drive control and wiring, complete for $130,000, five vertical traveling screens for intake crib, 12 three-speed selector switches complete with appurtenances, paper and lead covered cables valued at $1,500,000, "Mazda" lamps valued at $140,000 and 300 direct-current watthour meters 5 amp. to 2,000 amp. capacity.

Construction plans are as follows: The Ames Shovel & Tool Company, Anderson, Ind., plans plant additions to cost about $100,000. The Iowa City Light & Power Company, Iowa City, Iowa, will install additional equipment in its power plant in the Coralville district. Moorehead, Minn., will make extensions in its municipal lighting plant, at a cost of $35,000. The Board of Education, Rochester, Minn., plans a central power plant for school service, to cost about $100,000. Willmar, Minn., plans additions in its municipal electric light and water plant. The Elkhorn Valley Power Company plans a transmission line in vicinity of Scribner, Neb., to cost $25,000. Carrington, N. D., plans an ornamental lighting system. Battelle Memorial Institute, Columbus, Ohio, plans a group of laboratories and shops to cost about $500,000. The Ohio Power Company is planning an equipment storage and distributing plant at Crooksville, Ohio, to cost about $45,000. The Economy Rubber Products Company, Dayton, Ohio, plans a new plant to cost $125,000.

## *Many Projects Planned on Pacific Coast*

Miscellaneous projects on the Pacific Coast include new street-lighting systems for Tulare and Madera, a $250,000 apple refrigerating plant for Watsonville, a $5,000 fire-alarm addition to the Sacramento system, a $600,000 State teachers college for Santa Barbara, $3,000 worth of line material and telephone cable for the Delta district, $2,500 worth of reflectors for a Sacramento State Building, $1,500 worth of electrical equipment for a polytechnic school at San Luis Obispo and smaller power line jobs requiring about $2,500 of material each for south San Francisco and Marysville. An outstanding power line job for the Truckee Carson irrigation project near Fallon, Nev., requires

nearly $15,000 worth of material. Power company inquiries include 1 carload of pole line hardware. Large power construction, which will not materialize till the Fall, includes such projects as an approximate 40,000-kw. generating station in the Tiger Creek district and a $500,000 steam plant in the Bay Region. A central California company has projected a lighting, cooking and heating load campaign necessitating nearly a $400,000 expenditure the hiring of nearly 100 new salesmen and a $2,000,000 annual revenue rate reduction. Industrial orders include a $6,000 switchboard for an Hawaiian sugar plantation, and 2 motors, 75 hp. each, with accessories totaling $5,500 for a Sierra Lumber Company. Miscellaneous large construction announced includes a $200,000 addition to the United States naval base at Pearl Harbor, Hawaiian Islands, a $750,000 cement plant for Cajon Pass near Devore, a $1,250,000 building for a Los Angeles clothing company, and $2,000,000 to be spent by the government, $1,000,000 immediately on a complete air corps plant at March Field, Riverside. A feature of recent construction is the number of pedestrian tunnels necessitated by traffic accidents. They carry a high proportionate lighting installation.

Contracts closed in the Puget Sound district cover a number of motors for the Seattle cement plant of the Pacific Coast Company. The city of Seattle placed an order for approximately $66,000 worth of additional equipment for the Cedar Falls hydro-electric generating unit. Pump and motor business for irrigation and drainage of the eastern Washington orchard districts is maturing. A Seattle firm reports the sale of eight outfits last week. Sales of motors in Seattle to lumber mills, industrial plants, etc., aggregated more than 100 machines.

Construction projects are as follows: The California Portland Cement Company, Colton, Cal., will make plant extensions to cost about $500,000. Board of Education, Glendale, Cal., will build a power plant at its proposed new group high school. Los Angeles, Cal., plans an ornamental lighting system on Florence and Highland Avenues, and Landa Street. The Municipal Power & Light Bureau, Los Angeles, Cal., plans a substation and distributing plant on Broadway, Venice, to cost $225,000. Pasadena, Cal., plans an ornamental lighting system on Chester Avenue, using concrete standards. The Pacific Can Company, San Francisco, Cal., plans a new plant to cost about $500,000, with equipment.

Santa Ana, Cal., plans an ornamental lighting system on Bush Street. Santa Monica, Cal., plan an ornamental lighting system on Broadway. Blackfoot, Idaho, plans a municipal light and power plant. The Montana Power Company plans extensions in transmission lines at Simms and Fort Shaw, Mont., to cost about $30,000. The Utah Asphalt Corporation, care of John F. Cregon, Third Street and North Grand Avenue, Pueblo, Colo., engineer, plans a new electric-operated mining plant to cost more than $750,000, at properties near Price, Utah. The Smokeless Fuel Company, Salt Lake City, Utah, plans a new plant to cost in excess of $850,000. The Puget Sound Power & Light Company plans two substations in the vicinity of Bellingham, Wash.

### *Tone of Business Better in St. Louis District*

The general tone of business in the St. Louis district has been better. Contract for a 4,500-kw. turbo unit is reported closed. An order was placed for a 1,000-hp. motor for a government dredge boat at a cost of about $10,000, and another for a lot of 40-hp. and 75-hp. motors for a large stone company at a cost of $3,000. The movement of medium-sized motors has been steady. Several good shipments on conduit fittings and other construction materials are reported.

Construction projects in the district are as follows: The Camden Ice & Coal Company, Camden, Ark., will rebuild its ice plant, recently destroyed by fire, with loss reported in excess of $60,000. The Electric Ice Company, McCrory, Ark., plans an ice plant at Sheridan, Ark. The Central States Power & Light Corporation, Davenport, Iowa, has purchased power plant of the Church Point Light, Power & Ice Company, Church Point, La. The Southwest Power Company, McAlester, Okla., plans a substation at Rogers, Ark., and improvements in its system at Lowell, Ark., to cost about $35,000. The Southwestern Sales Corporation, Tulsa, Okla., plans power plant in the reservoir hills section. The Chamber of Commerce, Dallas, Tex., plans a local cotton mill to cost in excess of $650,000. The Standard Ice Company, Houston, Tex., will build an ice plant on the Harrisburg Boulevard, to cost $125,000. Vernon, Tex., is asking bids until Feb. 6, for one 360-hp. Diesel engine, direct-connected to electric alternator, with belt-driven exciter, switchboard, etc.

# Activities of the Trade

## Hygrade Lamp Company Buys Triumph Lamp Works

The Hygrade Lamp Company, Salem, Mass., announces the purchase of the plant and business of the Triumph Lamp Works, Indianapolis, Ind. F. A. Poor, treasurer of the Hygrade company, informs the ELECTRICAL WORLD that the business will be transferred to Salem, closing the Indianapolis factory and increasing the output of the Salem plant to 75,000 lamps per day, a gain of 25 per cent.

## Andrews-Bradshaw Merges with Blaw-Knox Company

The merger of the Andrews-Bradshaw Company of Pittsburgh, with the Blaw-Knox Company has just been consummated. The Andrews-Bradshaw Company is a Pennsylvania corporation whose principal product is known as the "Tracyfier"—a device for cleaning steam, gas, air and vapor. No change in the organization of the Andrews-Bradshaw Company is contemplated, with the exception that the products of that company will be manufactured in the main plant of the Blaw-Knox Company at Blawnox, Pa. The Andrews-Bradshaw Company will operate as the Andrews-Bradshaw division of the Blaw-Knox Company.

This merger gives to the Blaw-Knox Company an additional product for the power plant field, in which the company is already represented through its air preheaters, standard steel buildings, clamshell buckets, and electroforged steel grating. The company also manufactures steel forms for concrete construction, transmission towers and poles, road builders' equipment of all types, equipment for water cooling high temperature furnaces, and other products.

## Westinghouse Gets Orders for Carbon Circuit-Breakers

Two large orders for carbon circuit-breakers have been placed with the Westinghouse Electric & Manufacturing Company. The first, an order for 50 type CL carbon breakers of capacities ranging from 1,200 amp. to 10,000 amp., was sold to the American Rolling Mill Company. This order amounts to approximately $35,000. The second order, consisting of 75 hand-operated, plain automatic type CL carbon breakers, was sold to the Narragansett Electric Light Company. This order includes breakers of capacities from 1,200 amp. to 2,000 amp., and amounts to approximately $9,000.

THE TAPLET MANUFACTURING COMPANY, Philadelphia, announces the appointment of C. H. Van der Bloom, 3684 East 163d Street, Cleveland, as district representative for Taplet conduit fittings in the state of Ohio, Erie, Pa., and that part of New York State west of and including Rochester.

CURTIS LIGHTING, INC., Chicago, manufacturer of "X-Ray" reflectors, announces the appointment of Otis F. Fulhage as resident engineer in Des

Moines, Iowa. The company also announces that George R. Kelly has joined its Chicago sales force.

THE BOTFIELD REFRACTORIES COMPANY, Swanson and Clymer Streets, Philadelphia, manufacturer of "Adamant" firebrick cement, announces the appointment of Ires Prosser as Southeastern representative, with headquarters at Atlanta, Ga., to cover the entire Southeast from North Carolina to San Antonio, Tex.

THE OHIO BRASS COMPANY, Mansfield, Ohio, announces that Frank W. Gorman, formerly with the Mine & Smelter Supply Company, El Paso, Tex., has joined the organization as district sales representative and will make his headquarters in El Paso, covering the states of Arizona, the Panhandle section of Texas, New Mexico and Mexico. Mr. Gorman succeeds L. M. Keating who will assume duties in the general sales department of the company at Mansfield. The company also announces the opening of new offices at 703 Frisco Building, Ninth and Olive Streets, St. Louis. H. W. Kilkenny is district sales manager.

THE C. O. BARTLETT & SNOW COMPANY, Cleveland, announces the appointment of William W. Dodge as its sales representative in western New York with headquarters at Warsaw, New York.

THE OLIVER IRON & STEEL CORPORATION, Pittsburgh, announces that its line material department has appointed Frank P. Withers district manager with headquarters at 332 South Michigan Avenue, Chicago.

THE GENERAL ELECTRIC COMPANY announces the appointment of C. N. Gregory as manager of the New Haven, Conn., office, succeeding Frederic Cutts, and R. B. Ransom has been appointed resident agent in charge of the Hartford office, succeeding Mr. Gregory.

# New Equipment Available

## Gang-Operated Indoor Disconnecting Switches

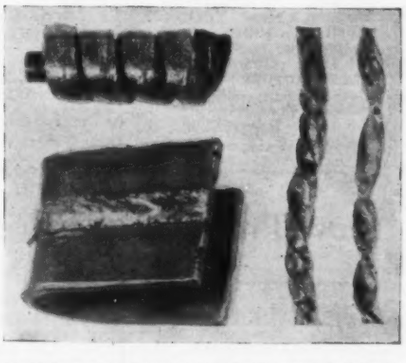
A new line of simplified gang operated indoor disconnecting switches has been developed by the Delta-Star Electric Company, Chicago. All units of the switches are mounted on a single steel base, thus permitting installation on pipe or angle iron frame. The interconnecting mechanism is placed on the back of this base, which permits a simplified mechanism. Appearance of the switch from the front is the same as any ordinary group of single-pole switches and secures the advantage of gang operation without additional space. These switches can be furnished for various ampere capacities, single-throw, double-throw or double-blade, double-throw. This new line of gang switches can also be arranged for either front, back or combination front and back connection. The voltage ratings are 7,500 volt and 15,000 volt.

## Air Preheater

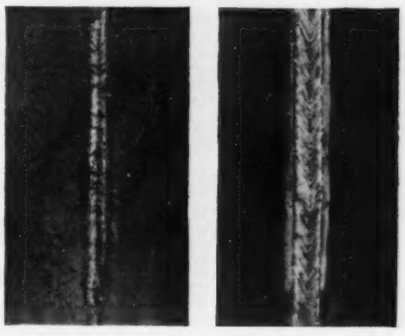
A new design of plate-type air preheater, placed on the market by the Combustion Engineering Corporation, 200 Madison Avenue, New York City, uses a welded assembly construction and is provided with clean-out doors. Access doors are provided in the heater casing to permit blowing the entire surface of the gas passages with steam or air lances. To eliminate any leakage from the air side to the gas side of the preheater, the elements are welded to the casing by means of a sealing strip, which also holds the elements in place and permits expansion of the elements relative to the casing. This construction is also said by the company to reduce greatly the amount of erection work necessary, as there are no bolted joints to be lined up. The air flow through the heater follows the "S"-flow design resulting in an effective transfer of heat from gas to air. In this design, the air inlet and air outlet are located on opposite sides of the heater, and the baffles are so arranged that all lanes of air travel are of approximately uniform length to assure an even distribution of air in all parts of the heater.

## Welding Method Gives Ductile and Low Cost Weld

The "electronic tornado" method of welding which was discovered in the research laboratories of the Lincoln Electric Company, Cleveland, about twelve months ago has been further developed to the point of commercial application. The company states that not only are the welds produced by this new process far more uniform in structure and ductility but the cost of welding is lower than that of other methods. It is stated that the cost of welding ½-in. plates, including operator's time, electric current and carbon electrode will not exceed 3 cents per running foot of weld. The cost of welding plate of other thicknesses will be proportionate. While it is not thought at the present time that the "electronic tornado" method will affect the manual arc welding process equipment which can be welded automatically will use the new principle. Welds can be applied equally well to thick or thin plates.



DUCTILE WELDS MADE BY THE NEW PROCESS. WELDS WERE TWISTED THROUGH 1,080 DEG. WITH NO SIGN OF FAILING



METALLIC ARC WELD AT LEFT COMPARED WITH WELD MADE BY THE ELECTRONIC TORNADO METHOD

Metal deposited by electric arc welding has the characteristics of cast steel. By this new process the metal deposited in the weld has equal or even better physical characteristics than the metal of the plates joined by welding. This is a result of the purifying effect of the electronic tornado. An incidental advantage of electronic tornado welding is the smooth finish which is obtained on the welding bead. This in part is caused by the higher speed of travel of the welding heads and is in part inherent in the new process.

## Portable Winch

A new portable winch, designed especially for public utility work, has been placed on the market by the Yale & Towne Manufacturing Company, Stamford, Conn. Remote control of loads is obtained and upper and lower limit stops are incorporated. A special feature of the equipment is the fact that, by fitting a lower hook and sheave wheel and anchoring the load chain to the crane boom, the lifting capacity is doubled and the hoisting speed is reduced by one-half. A hand chain-wheel is fitted to the hoist sprocket so that the motor can still be operated by hand after the motor brake has been released by one of the manual control handles.

DROP FORGED INSULATOR CAPS.—A new line of drop forged insulator caps has been placed on the market by the American Forge & Machine Company, Canton, Ohio. These caps, which are of the ball and socket type, have been tested up to 36,000 lb. and a routine test of 30,000 lb. is made without the caps showing any distortion. The caps are hot-dip galvanized.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued Jan. 3, 1928)

**1,654,563.** ELECTRICAL WELDING MACHINE; A. C. Taylor, Warren, Ohio. App. filed Jan. 16, 1925.

**1,654,576.** WAVE DEVIATION METER; L. W. Chubb, Edgewood, Pa. App. filed June 6, 1924. For the determination of the deviation of alternating-current equipment from the theoretical or true sine-wave characteristics.

**1,654,599.** FITTING TABLE HEATER; E. J. Ovington, Auburndale, Mass. App. filed Feb. 5, 1926. For fitting a spectacle frame.

**1,654,613.** ELECTRIC SWITCH; I. E. Smith, Stockton, Calif. App. filed March 8, 1926. Motor-starting magnetic switch.

**1,654,643.** MAIL BOX SWITCH; J. P. Gennoy, Oakland, Calif. App. filed Dec. 9, 1922. With signal device.

**1,654,646.** ELECTROMAGNETIC CONTACTOR; W. G. Hartwig, Chicago, Ill. App. filed Jan. 22, 1923. For use in connection with heating or cooling apparatus.

**1,654,650.** SAFETY APPLIANCE; F. Hymans, Yonkers, N. Y. App. filed April 15, 1926. For elevators.

**1,654,657.** CABLE TERMINAL; E. M. Matthews, Jamaica, N. Y. App. filed April 16, 1924. Adapted to distribute conductors fanned out from electric cables.

**1,654,660.** CONNECTER; J. A. McKay, Toronto, Ontario, Canada. App. filed June 20, 1924. For joining relatively small wires such as are used in lighting fixtures.

**1,654,705.** STORAGE BATTERY; C. E. Schlossnagel, Swissvale, Pa. App. filed Jan. 29, 1927. Vent plug.

**1,654,730.** MAXIMUM-DEMAND METER; F. C. Holtz, Springfield, Ill. App. filed Dec. 10, 1923.

**1,654,768.** ELECTROTHERAPEUTIC MACHINE; J. B. Wants, Oak Park, Ill., and A. A. Grothe, Chicago, Ill. App. filed March 13, 1925.

**1,654,774.** ROTOR SHAFT AND BEARING SUPPORT FOR ELECTRIC MOTORS; A. Arutunoff, Jackson, Mich. App. filed June 14, 1924. For motors or other structures requiring a long shaft with a long rotor.

**1,654,776.** SHORT-CIRCUITING DEVICE; E. C. Ballman, St. Louis, Mo. App. filed Sept. 4, 1925. For single-phase motors.

**1,654,778.** PREFORMED POSITIVE ELECTRODE AND PROCESS OF MAKING THE SAME; R. C. Benner, Bayside, N. Y., and J. H. Fink, Brooklyn, N. Y. App. filed July 10, 1923.

**1,654,779.** PROCESS OF MAKING PREFORMED NEGATIVE ELECTRODES; R. C. Benner, Bayside, N. Y.; A. J. Briggs, Syracuse, N. Y., and J. H. Fink, Brooklyn, N. Y. App. filed July 10, 1923.

**1,654,813.** ELECTRIC SWITCH; C. H. Jockmus, Ansonia, Conn. App. filed Oct. 11, 1923. Pull-chain switch for electric lamp socket.

**1,654,823.** FLASHLIGHT BATTERY; W. R. Millar, Palmerston, Ontario, Canada. App. filed Jan. 21, 1927.

**1,654,838.** BRANCH TERMINAL FOR OVERHEAD LINES; W. Schroeder and J. Nolte, Bruckhausen, Germany. App. filed June 15, 1925.

**1,654,840.** INDUCTION MOTOR; P. F. Shivers, Wabash, Ind. App. filed April 9, 1925. Field-magnet core.

**1,654,842.** ELECTRIC HEATING DEVICE; L. A. Smith and R. Rzeminiecki, Washington, D. C. App. filed May 14, 1927.

**1,654,860.** ELECTRIC HEATER; J. H. Carmean, Kansas City, Mo. App. filed Feb. 5, 1926. Portable heater.

**1,654,910.** PROCESS FOR TREATING ARTICLES IN METALLIC BATHS; N. J. Barbier, St. Etienne-Loire, France. App. filed Oct. 28, 1925.

**1,654,928.** CONTROL AND INDICATING SYSTEM FOR ELECTRIC RAILWAYS; J. C. Field, Orange, N. J., and F. Zogbaum, New York, N. Y. App. filed Sept. 28, 1923.

**1,654,931.** THEFT-ALARM DEVICE; M. Greene, New York, N. Y. App. filed June 4, 1926.

**1,654,937.** REGULATOR OF ELECTRIC DISTRIBUTION SYSTEMS; H. de B. Knight, Rugby, England. App. filed July 27, 1926. Particularly from direct-current supply means, such as rotary converters, generators, rectifiers or the like, which are operating in parallel with vapor electric discharge devices, such as mercury-arc rectifiers or tungar rectifiers, in which the voltage of the direct-current output can be controlled by control electrodes.

**1,654,948.** REGULATOR; L. W. Thompson, Schenectady, N. Y. App. filed Oct. 24, 1925. For regulating the voltage.

**1,654,956.** CONTROL APPARATUS; E. W. Allen, Schenectady, N. Y. App. filed April 30, 1925. Reactance control apparatus.

**1,654,971.** GENERAL ALARM SYSTEM FOR BATTLESHIPS; P. S. Grierson, South Orange, N. J. App. filed Sept. 21, 1921.

**1,654,979.** REGULATION OF ELECTRIC DISTRIBUTION SYSTEMS; H. de B. Knight, Rugby, England. App. filed Oct. 4, 1926.

**1,654,983.** CIRCUIT INTERRUPTER; W. O. Lum, New York, N. Y. App. filed Dec. 2, 1924.

**1,654,986.** REVERSING SWITCH; W. R. McCathran, Washington, D. C. App. filed Nov. 24, 1922.

**1,654,987, 1,654,988, 1,654,989.** REGULATOR; A. H. Mittag, Schenectady, N. Y. Apps. filed Oct. 28, 1925, and March 10, 1927. For regulating the voltage.

**1,655,009.** SPEED-GOVERNING MECHANISM; W. A. Browne, Washington, D. C. App. filed Dec. 29, 1922.

**1,655,026.** ELECTROLYTIC CELL; H. O. Siegmund, West Orange, N. J., and B. E. Brown, Mountain Lakes, N. J. App. filed Sept. 16, 1924.

**1,655,034.** ADJUSTABLE REACTION RESISTANCE; F. J. Zamboni, Hynes, Calif. App. filed Jan. 24, 1925.

**1,655,193.** HEATER ATTACHMENT FOR ELECTRIC FANS; M. Murphy, Rushville, Ind. App. filed Aug. 9, 1926.

**1,655,220.** THREE-POSITION RELAY; T. E. Clark, Detroit, Mich. App. filed May 2, 1925. For train control.

**1,655,231.** VEHICLE DRIVING APPARATUS AND SYSTEM; A. V. Livingston, New Haven, Conn. App. filed July 11, 1925.

**1,655,237.** PROTECTIVE RELAY FOR SERIES RELEASES; W. H. Petersen, Ludvika, Sweden. App. filed Dec. 11, 1925.

**1,655,244.** TELEMETRIC SUMMATION SYSTEM; R. M. Rowell, Lynn, Mass. App. filed May 7, 1925.

**1,655,252.** FREQUENCY CHANGER; R. A. Warner, Schenectady, N. Y. App. filed Dec. 10, 1926.

**1,655,258.** HIGH-TENSION CABLE JOINT; W. E. Boyle, New York, N. Y. App. filed March 22, 1923.

**1,655,277.** ELECTRICAL HEATING SYSTEM; G. N. Madsen, Minneapolis, Minn. App. filed Jan. 25, 1926.

**1,655,279.** MOUNT-MAKING MACHINE; M. E. McGowan, Newark, N. J. App. filed Nov. 25, 1921. Incandescent-lamp mounts.

**1,655,286.** ELECTRIC MOTOR; H. E. Nietsche, Detroit, Mich. App. filed April 13, 1925. Of the portable type adapted to be utilized with small storage batteries of low voltage.

**1,655,307.** PROTECTIVE ARRANGEMENT FOR ALTERNATING-CURRENT ELECTRIC CIRCUITS; R. W. Biles, Balcombe, England. App. filed Jan. 21, 1927.

**1,655,324.** ELECTRIC FURNACE; P. L. J. Miguet, St.-Julien-de-Maurienne, France. App. filed Sept. 29, 1926.

**1,655,334.** ELECTROMAGNETIC PROTECTIVE DEVICE; W. H. Peterson, Ludvika, Sweden. App. filed Dec. 11, 1925.

**1,655,384.** REGULATING DEVICE; C. A. Bonerz, New York, N. Y. App. filed April 7, 1923. Applicable to thermo-responsive regulators.

**1,655,388.** COMPOSITION AND PROCESS OF MANUFACTURE; F. J. Groten, Jr., Meriden, Conn. App. filed Nov. 23, 1922. For molded products.

**1,655,389.** REGULATOR; A. W. Hull, Schenectady, N. Y. App. filed Jan. 7, 1926.

# New Trade Literature

APPLIANCES.—The Fitzgerald Manufacturing Company, Torrington, Conn., is distributing pamphlets describing the new "Star-Rite" violet-ray machine and the electric mixer.

INSTRUMENTS.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-903, describing and illustrating types G-9 and GS-9 demand meters. The company is also distributing bulletin GEA-896, describing its oscilloscopes.

CIRCUIT BREAKERS.—Bulletin No. 580 issued by the Roller-Smith Company, 233 Broadway, New York City, covers its types ESF, ES and EI inclosed circuit breakers.

COMBUSTION EQUIPMENT AND BURNER.—The Riley Stoker Corporation, Worcester, Mass., is distributing a catalog which gives information on combustion equipment for the office building, apartment house, hotel and school. The company has also issued a leaflet describing its new flare-type pulverized-coal burner.

ARC WELDER.—Bulletin GEA-875A issued by the General Electric Company, Schenectady, N. Y., describes its belt, motor or gas-engine driven, stationary or portable, self-excited, constant-energy, single-operator type WD-300A arc welder.

AUTOMATIC MINING SUBSTATIONS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has published circular No. 1785, describing automatic mining substations. It contains a general description of the apparatus, operation, etc., and also a wiring and schematic diagram for an automatic mining synchronous converter.

CONDUIT FITTINGS.—The Appleton Electric Company, 1701 Wellington Avenue, Chicago, is distributing bulletin 9-A, in which is listed a complete line of Appleton no-thread "unilets" and covers. Dimension diagrams for various types of no-thread unilet bodies are included.

SPEED REDUCERS. — The Albaugh-Dover Manufacturing Company, 2100 Marshall Boulevard, Chicago, has issued bulletin "A," covering the A.D. speed reducers. Illustrations and dimensions of the various types are included.

AUTOMATIC TIME SWITCHES.—Bulletin GEA-913 issued by the General Electric Company, Schenectady, N. Y., describes and illustrates its types T-8 and T-9 motor-operated automatic switches, for use only on alternating-current circuits with regulated frequency.

CRANES. — The Whiting Corporation, Harvey, Ill., has issued catalog No. 209, superseding No. 200, covering its complete line of cranes. This catalog contains many illustrations of crane installations.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Sydney, Australia (No. 29,226), for electrical appliances.

An agency is desired in Bogota, Colombia (No. 29,118), for flashlights and lanterns.

An agency is desired in São Paulo, Brazil (No. 29,173), for household electrical appliances.

Purchase or agency is desired in Manchester, England (No. 29,172), for household electrical appliances, especially vacuum cleaners.

An agency is desired in Lwow, Poland (No. 29,175), for electric motors.

Purchase or agency is desired in Leipzig, Germany (No. 29,144), for electric refrigeration machinery.

Purchase is desired in Rome, Italy (No. 29,168), of automatic traffic signals.

Purchase is desired in Copenhagen, Denmark (No. 29,174), of electric portable tools.

J. C. Cladder, Jr., 566 Amstelveenscheweg, Amsterdam, Netherlands, desires an agency for electric dishwashers, potato peelers, ice cream freezers and any other electric kitchen machinery for hotel, hospital and steamship use.

Four German firms are interested in purchasing and eventually acting as agents for American vacuum cleaners and floor polishers adapted to alternating current, 50 cycles, according to word received from Consul F. van den Arend, Leipzig. Berndt, Lax & Company, Thomasgasse, Leipzig, is interested in catalogs and quotations for an initial shipment of twenty cleaners and five polishers; Hess and Klanck, Einertstrasse 3, Leipzig, is interested in catalogs and quotations on an initial shipment of fifteen cleaners and five polishers; Iskar Apitzsch, Haus & Kuchengerate, Leipzigerstrasse 2, Delitzsch, is interested in catalogs and quotations for a trial shipment of ten vacuum cleaners, also agency terms. Wolf Seelenfreund, Magdeburg, Germany, is interested in catalogs and quotations on an initial shipment of 25 vacuum cleaners.